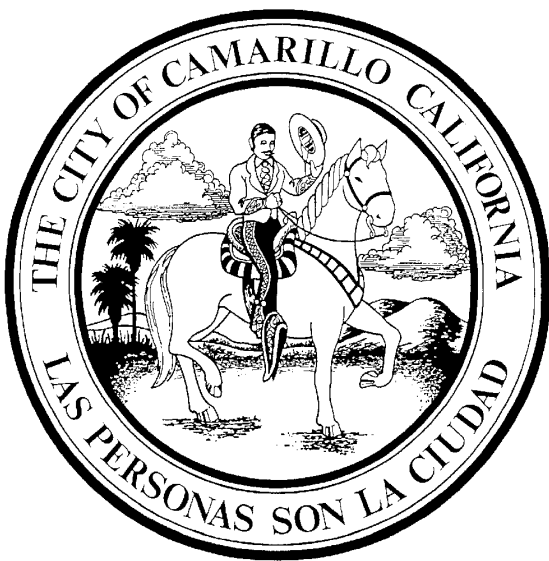
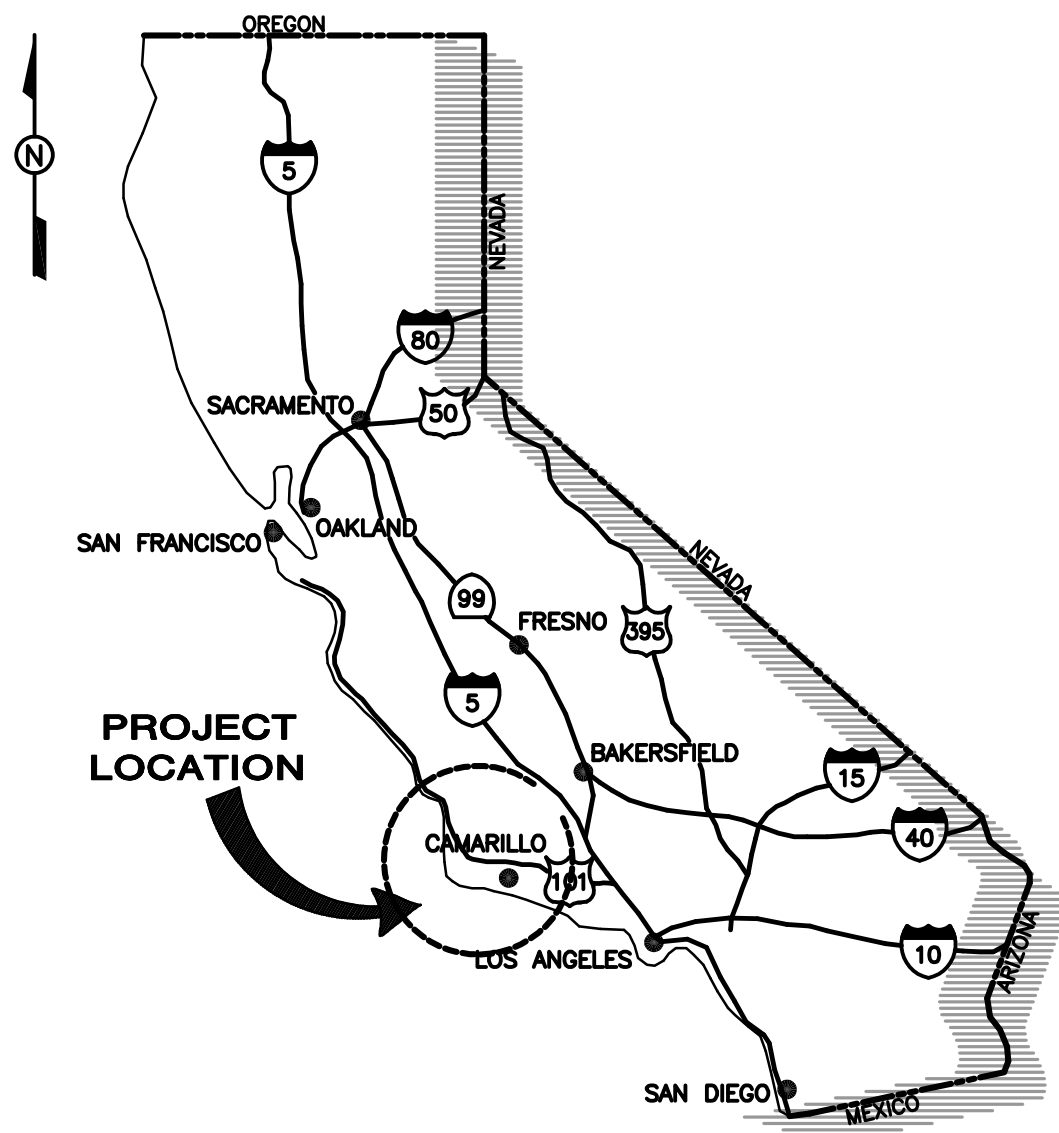


CITY OF CAMARILLO

CAMARILLO SANITARY DISTRICT



CAMARILLO TERTIARY EFFLUENT PIPELINE INSTALLATION PROJECT NUMBER SS-03-03 2009



VICINITY MAP

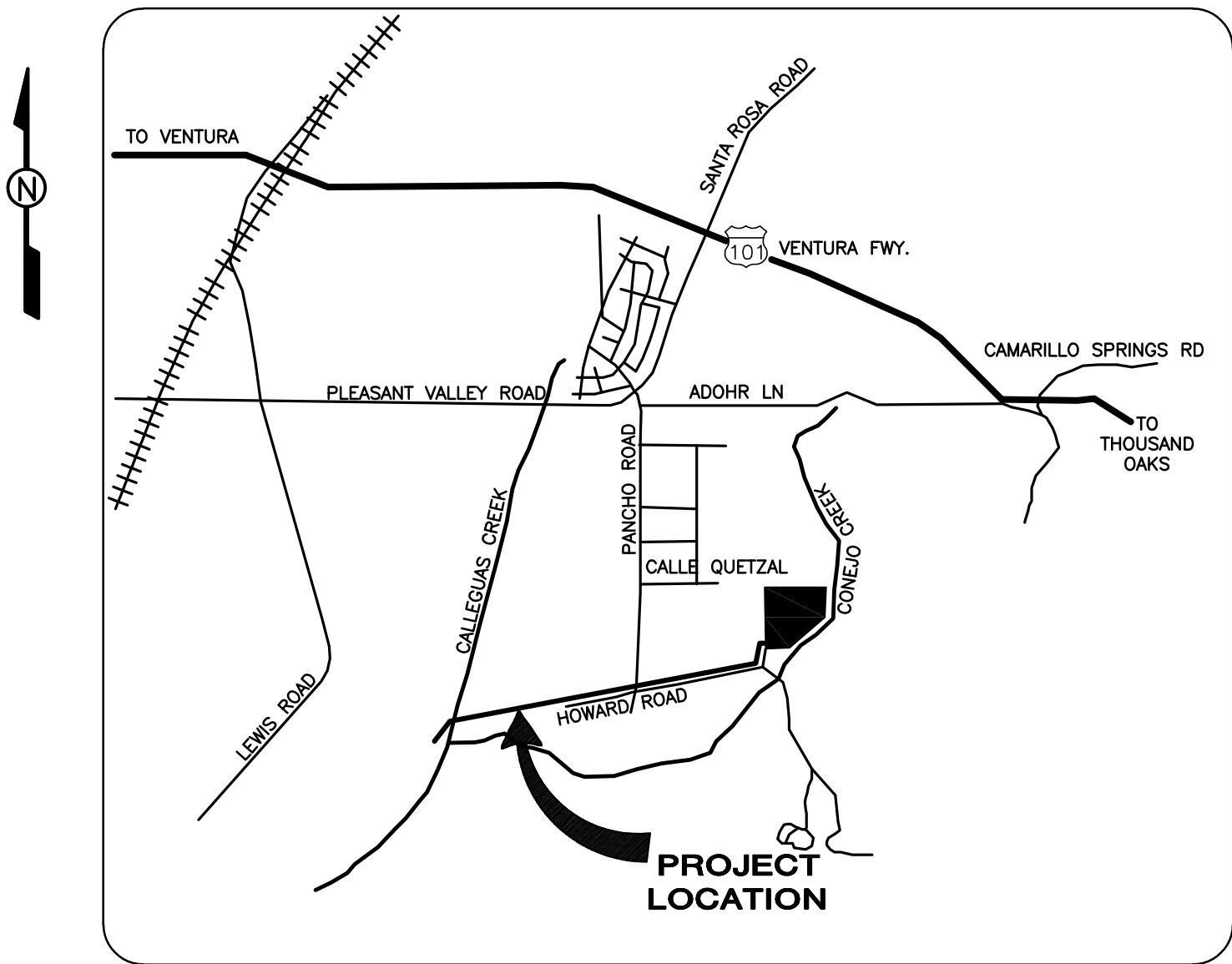
COORDINATES AND BEARINGS ARE BASED UPON CALIFORNIA COORDINATE SYSTEM, NORTH AMERICAN DATUM OF 1927 (U.S. SURVEY FEET), AS SHOWN ON VENTURA COUNTY FIELD BOOK 1937-A, PAGE 143, AND VENTURA COUNTY HORIZONTAL CONTROL DATA BOOK 236-1692, PAGE 5.

PT. NO. 1 ("CON 83-7"):
N 254176.460 E 198267.260
CONCRETE NAIL, NO TAG, IN TOP OF BIG BOULDER.

PT. NO. 3:
N 253765.811 E 1894194.580
2" BRASS DISC IN CONCRETE, FLUSH.

PT. NO. 998 ("CC-1"):
N 251812.100 E 1693931.730
BRASS DISC STAMPED "CC-1 1971" SET IN CONCRETE, DOWN 0.5'.


BENCHMARK:
B.M. NO. CC-1 NAVD 1927 ELEVATION=99.03'
FOUND A VENTURA COUNTY STANDARD BRASS DISC STAMPED "CC-1 1971"
SET IN CONCRETE CORE DOWN 0.5'.
NORTH OF CONEJO CREEK AND 23'± WEST OF PANCHO ROAD.



LOCATION MAP

NOT TO SCALE



<div>PREPARED BY:  10540 TABLERT AVE., SUITE 200E FOUNTAIN VALLEY, CALIFORNIA 92708 TEL. (714)-583-5100</div> <div>APPROVED: ALLEN C. TODD, PARTNER RCE 28323 EXP 3-31-10</div>	APPROVED: CITY OF CAMARILLO NAFTALIA TUCKER CITY ENGINEER RCE 50878 EXP 9-30-11		CAMARILLO SANITARY DISTRICT CITY OF CAMARILLO VENTURA COUNTY, CALIFORNIA	
	REVIEWED: DOUG FROST JR. WATER RECLAMATION SUPERINTENDENT		CAMARILLO TERTIARY EFFLUENT PIPELINE INSTALLATION	
	REVIEWED: LUCIA MCGOVERN DEPUTY DIRECTOR/ENVIRONMENTAL ENGINEER		COVER SHEET	
	PROJECT NO. SS-03-03		F.B. P.G. SHEET 1 OF 11 C-15036	

INDEX OF DRAWINGS

SHEET NO.	DRAWING NO.	DESCRIPTION OF DRAWINGS
1	G01	COVER SHEET
2	G02	GENERAL NOTES, SYMBOLS AND ABBREVIATIONS
3	EP01	EFFLUENT PIPE PLAN AND PROFILE
4	EP02	EFFLUENT PIPE PLAN AND PROFILE
5	EP03	EFFLUENT PIPE PLAN AND PROFILE
6	EP04	EFFLUENT PIPE PLAN AND PROFILE
7	EP05	EFFLUENT PIPE PLAN AND PROFILE
8	EP06	EFFLUENT PIPE PLAN AND PROFILE
9	T01	DETAILS
10	T02	DETAILS
11	T03	DETAILS

A MINIMUM OF 48 HRS PRIOR TO
THE START OF THE CONSTRUCTION

**Call
UNDERGROUND
SERVICE
ALERT**
1-800-422-4133

GENERAL NOTES

1. SECTION 4212/4217 OF THE GOVERNMENT CODE REQUIRES A USA IDENTIFICATION NUMBER TO BE ISSUED BEFORE A PERMIT TO EXCAVATE WILL BE VALID. CALL FOR ID NUMBER:

UNDERGROUND SERVICE ALERT
TOLL FREE 1-800-422-4133

A MINIMUM OF TWO WORKING DAYS BEFORE DIGGING FOR BEST RESPONSE, PROVIDE AS MUCH NOTICE AS POSSIBLE, UP TO TEN (10) WORKING DAYS.
2. CONTRACTOR SHALL POTHOLE ALL CROSSING AND CONNECTING UTILITIES BEFORE STARTING CONSTRUCTION AND PROVIDE ELEVATIONS OF TOP OF PIPE, SIZE OF PIPE, AND INVERT OF PIPE TO ENGINEER. POTHOLES SHALL BE IMMEDIATELY FILLED, INCLUDING PAVEMENT, AS SOON AS MEASUREMENTS ARE TAKEN.











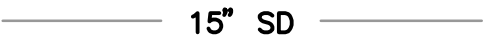









A. CONTRACTOR SHALL PROTECT ALL EXISTING UTILITIES, INCLUDING WATER AND DRAINAGE SERVICES AND ACCESS ROADS, ETC. DURING CONSTRUCTION AND ENSURE THEY REMAIN IN PLACE AND OPERATIONAL.
3. THE DISTRICT WILL ACQUIRE ALL ENCROACHMENT PERMITS PRIOR TO CONSTRUCTION.
4. ALL WORK, EXCEPT AS OTHERWISE SHOWN OR SPECIFIED, SHALL BE DONE IN ACCORDANCE WITH THE SPECIFICATIONS AND PLANS OF THE CAMARILLO SANITATION DISTRICT AND THE STANDARD SPECIFICATIONS FOR PUBLICWORKS CONSTRUCTION, LATEST EDITION, WHERE NOT COVERED BY THE FORMER, AND SHALL BE COMPLETED TO THE SATISFACTION OF THE CAMARILLO CITY ENGINEER. WHEN THERE IS CONFLICT, THE MORE STRINGENT REQUIREMENT SHALL APPLY.
5. WORK MUST BE PERFORMED TO THE SATISFACTION OF THE CITY ENGINEER.
6. THE CONTRACTOR SHALL NOTIFY THE DISTRICT AT LEAST FIVE WORKING DAYS PRIOR TO BEGINNING OF CONSTRUCTION AT (805) 482-4677 AND CAMARILLO SANITARY DISTRICT AT (805) 388-5332.
7. THE CONTRACTOR SHALL WORK SAFELY AT ALL TIMES AND SHALL FURNISH, ERECT, AND MAINTAIN SUCH FENCES, BARRICADES, LIGHTS, AND SIGNS NECESSARY TO GIVE ADEQUATE PROTECTION TO THE PUBLIC AT ALL TIMES. TEMPORARY TRAFFIC CONTROL SHALL BE APPROVED BY THE CITY OF CAMARILLO CITY ENGINEER.
8. ALL EXCAVATIONS OR TRENCHES IN PAVED AREAS SHALL REQUIRE SAWCUTTING IN A NEAT AND UNIFORM MANNER. ALL MATCH OR JOIN LINES TO EXISTING ASPHALTIC CONCRETE PAVING WITHOUT REDWOOD HEADERS SHALL BE SAW CUT.
9. ALL SEWER CROSSINGS OF PUBLIC WATER MAINS SHALL BE IN ACCORDANCE WITH CALIFORNIA DEPT OF PUBLIC HEALTH STANDARDS.
10. CONTRACTOR TO LOCATE, PROTECT, AND REPAIR AT HIS EXPENSE, ANY UTILITIES DAMAGED BY HIS FORCES OR AS A RESULT OF HIS WORK.

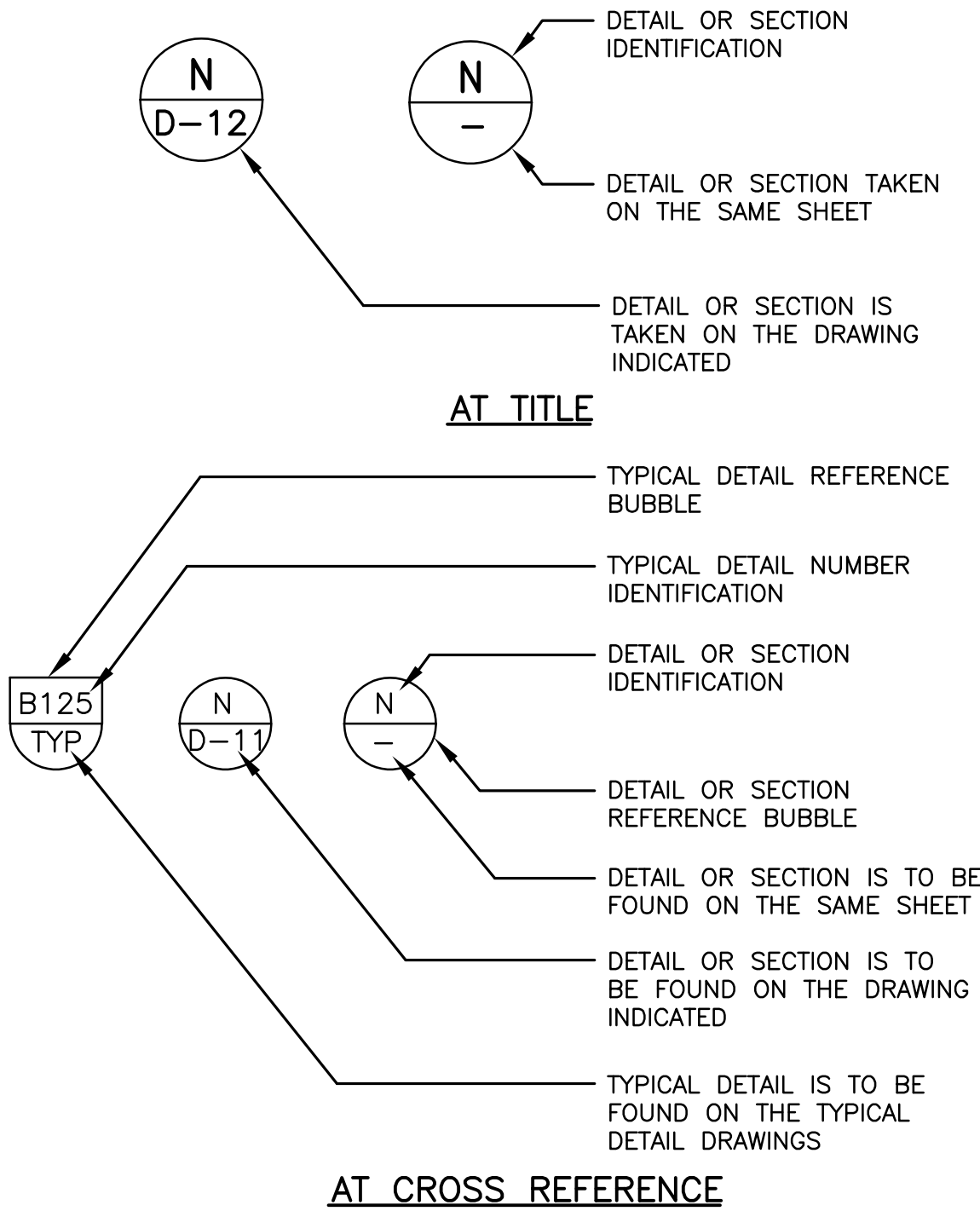
11. ALL STREETS, ALLEYS, VEHICULAR WAYS, SIDEWALKS, AND HAUL ROUTES SHALL BE KEPT CLEAN AND CLEAR OF DEBRIS, DIRT AND DUST IN A MANNER ACCEPTABLE TO THE CITY OF CAMARILLO. AT A MINIMUM, THESE AREAS SHALL BE CLEANED AT THE END OF EACH WORK DAY. FAILURE TO DO SO WILL RESULT IN A "STOP WORK" NOTICE. SAID NOTICE WILL NOT BE RELEASED UNTIL THE AREA HAS BEEN ADEQUATELY CLEANED.
12. ALL VALVE AND MANHOLE COVERS SHALL BE ADJUSTED TO GRADE, PER DISTRICT STANDARDS.
13. THE CONTRACTOR SHALL HAVE COPIES OF APPROVED PLANS AND SPECIFICATIONS FOR THIS PROJECT ON THE JOB SITE AT ALL TIMES, CONTRACTOR SHALL BE FAMILIAR WITH ALL APPLICABLE STANDARDS AND SPECIFICATIONS.
14. CONTRACTOR TO OBTAIN A PERMIT FROM DEPARTMENT OF INDUSTRIAL RELATIONS, DIVISION OF OCCUPATIONAL SAFETY AND HEALTH (CAL-OSHA) WHEN TRENCH EXCAVATIONS EXCEED 5'-0" IN DEPTH OR WHEN OTHERWISE REQUIRED. CONTACT CAL-OSHA AT (818) 901-5403 FOR FURTHER INFORMATION (HEALTH AND SAFETY CODE 17922.5).
15. ALL COMPACTION TEST RESULTS WITHIN CITY STREETS OR RIGHT-OF-WAY AND EASEMENTS SHALL BE SUBMITTED DIRECTLY TO THE CITY OF CAMARILLO, PUBLIC WORKS DEPARTMENT, ENGINEERING DIVISION AS WELL AS THE DISTRICT BY THE APPROVED TESTING COMPANY AT TIME OF FIRST AVAILABILITY OF RESULTS.
16. REMOVE AND REPLACE INTERFERING SIGNS ALONG PIPELINE ALIGNMENT.
17. ABOVE GROUND FERROUS METALS SHALL BE SAND BLASTED TO NEAR WHITE (SSPC-SP-10) AND AND IMMEDIATELY COATED WITH TWO COATS OF HIGH SOLIDS EPOXY (TNEMEC 135 AT 5 MILS MIN EACH) FOLLOWED BY ONE OR MORE COATS OF ALIPHATIC POLYURETHANE (TNEMEC 73 AT 4 MILS MIN). COLOR SELECTED BY DISTRICT.
18. PROVIDE LOCATOR WIRE AND TAPE ALONG ALL BURIED PIPELINES. TAPE SHALL BE SETON, 4 MIL X 6" WIDE POLYETHYLENE FILM WITH CONTINUOUS WORDING "CAUTION - RECYCLED WATER PIPELINE BELOW". TAPE SHALL BE RECYCLED WATER PURPLE AND IN ACCORDANCE WITH APPLICABLE REGULATION.
19. INSTALL RESTRAINED JOINTS ON PIPE WHERE NOTED ON THE DRAWINGS.
20. ALL POWER, TELEPHONE AND SIMILAR POLES AND FACILITIES, INCLUDING GUYS AND ANCHORS, SHALL BE PROTECTED PER THE POLE OWNER'S REQUIREMENTS AT NO COST TO THE CONTRACT. CONTRACTOR SHALL NOTIFY THE UTILITY COMPANY 10 WORKING DAYS PRIOR TO CONSTRUCTION WITHIN 50 FEET OF ANY POLE, GUY OR ANCHOR.
21. WATER FROM DEWATERING OPERATIONS SHALL BE GIVEN PRETREATMENT AND THEN DISPOSED OF WITHIN THE OWNER'S WASTEWATER TREATMENT FACILITY PER SECTION 02240 OF THE SPECIFICATIONS. THE POINT OF DISPOSAL WITHIN THE WWTF WILL BE WITHIN 1,600 FEET OF PIPELINE STATION 67+85. ROUTING OF DISPOSAL PIPELINE SHALL BE AS DIRECTED BY OWNER.
22. MAINTAIN AT LEAST ONE LANE OF TRAFFIC ON HOWARD ROAD AND AT THE INTERSECTION OF HOWARD AND PANCHO ROADS DURING WORKING HOURS AND TWO LANES OF TRAFFIC AT ALL OTHER TIMES.
23. PROVIDE ADEQUATE AND APPROVED DUST CONTROL MEANS, INCLUDING WATER SPRAYS AND DUST FENCES, TO PROTECT CROPS FROM DAMAGES.
24. REMOVE AND PROPERLY DISPOSE OF CONTENTS OF EXISTING PIPELINES WHEN MAKING CONNECTIONS.

AC	ASPHALT CONCRETE PAVEMENT
ACP	ASBESTOS CEMENT PIPE
BC	BEGINNING OF CURVATURE
BF	BLIND FLANGE, BOTTOM FLAT
BFV	BUTTERFLY VALVE
CI	CAST IRON
CL OR \varnothing	CENTER LINE
CLF	CHAIN LINK FENCE
CLR	CLEAR
CMLC	CEMENT MORTAR LINED & COATED
CO	CLEANOUT
CONC	CONCRETE
CONST	CONSTRUCT
CSD	CAMARILLO SANITARY DISTRICT
CWD	CAMROSA WATER DISTRICT
D	DIAMETER OF PIPE
DIA	DIAMETER
DIP	DUCTILE IRON PIPE
DP	DIVERSION PIPELINE
DWG	DRAWING
E	EAST
EA	EACH
EC	END OF CURVATURE
ECC	ECCENTRIC
EL	ELEVATION
ESMT	EASEMENT
EW	EACH WAY
EXIST	EXISTING
FC	FLEXIBLE COUPLING
FH	FIRE HYDRANT
FT	FOOT
HORIZ	HORIZONTAL
HPP	HIGH PRESSURE PIPELINE
ID	INSIDE DIAMETER
IE	INVERT ELEVATION
IN OR "	INCH
INV	INVERT
LP	LIGHT POLE
LT	LEFT
MAX	MAXIMUM
MIN	MINIMUM
MH	MANHOLE
N	NORTH
N/A	NOT APPLICABLE
NO OR #	NUMBER
NT'D	NOTED
NTS	NOT TO SCALE
PERM	PERMANENT
OD	OUTSIDE DIAMETER
OH	OVERHEAD
PE	PERMANANT PIPELINE EASEMENT
PL OR P L	PROPERTY LINE
PP	POWER POLE
PT	POINT
PVC	POLYVINYL CHLORIDE
PVCWD	PLEASANT VALLEY COUNTY WATER DISTRICT
RCP	REINFORCED CONCRETE PIPE
REINF	REINFORCEMENT, REINFORCING
REQD	REQUIRED
REV	REVISION
RJ	RESTRAINED JOINT
RT	RIGHT
R/W	RIGHT OF WAY
VCFCD	VENTURA COUNTY FLOOD CONTROL DISTRICT
S	SOUTH, SLOPE
SF	SQUARE FEET
SL	SURVEY LINE
STA	STATION
STD	STANDARD
TB	THRUST BLOCK
TBM	TEMPORARY BENCH MARK
TCE	TEMPORARY CONSTRUCTION EASEMENT
TEMP	TEMPORARY
TF	TOP FLAT

TYP	TYPICAL
UNO	UNLESS NOTED OTHERWISE
UG	UNDERGROUND
VERT	VERTICAL
W	WEST

SYMBOL LEGEND

EXISTING SEWER	
NEW EFFLUENT PIPELINE	
ABANDONED SEWER	
EXISTING GAS	
EXISTING UNDERGROUND GTE DUCT	
EXISTING UNDERGROUND ELECTRICAL	
EXISTING OVERHEAD ELECTRICAL	
EXISTING WATER MAIN	
EXISTING WATER GATE VALVE	
EXISTING STORM DRAIN	
EASEMENT	
EXISTING CONTOURS	
EXISTING SPOT ELEVATIONS	
FENCE	
EXISTING POWER POLE	
LIGHT POLE	
EXISTING MANHOLE	
FIRE HYDRANT	
PROPERTY LINE	
RIGHT OF WAY	

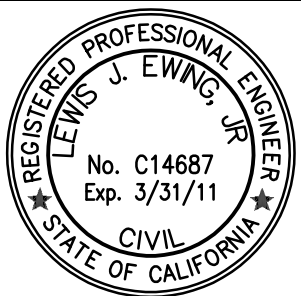


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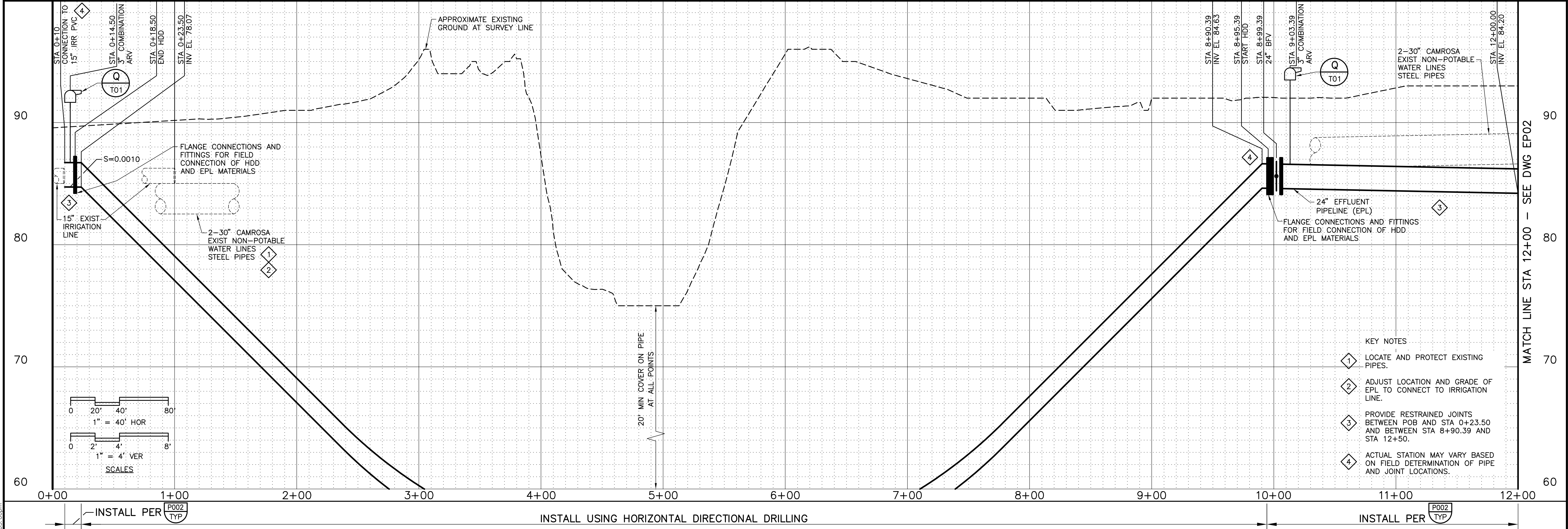
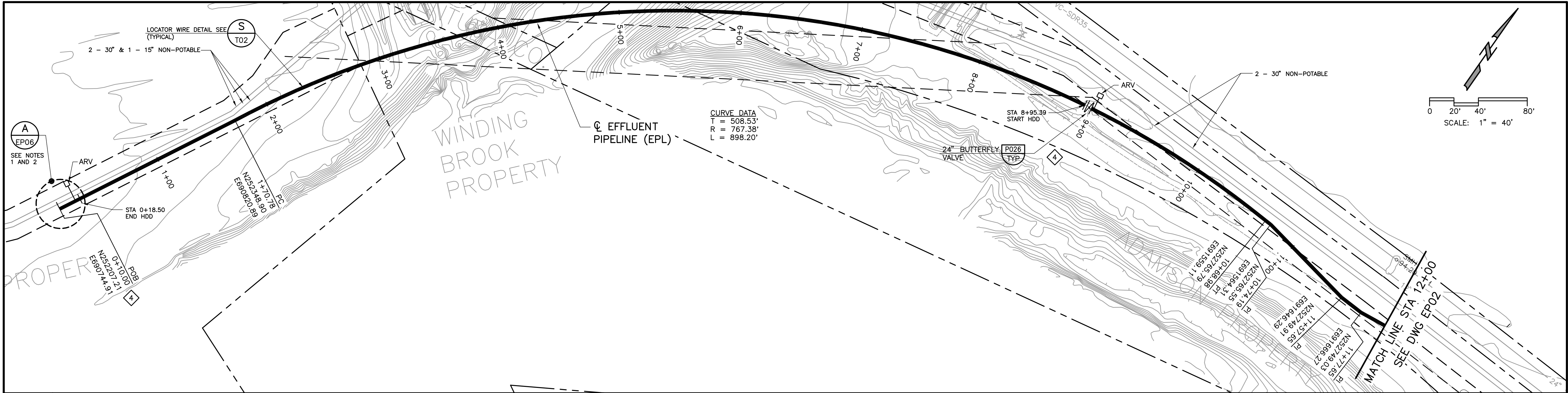
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DEPUTY DIRECTOR/CITY ENGINEER RCE 50878	DATE EXP 9-30-11
REVIEWED: WATER RECLAMATION SUPERINTENDENT	DATE
REVIEWED: DEPUTY DIRECTOR/ENVIRONMENTAL ENGINEER	DATE



DESIGNED : LJE	DATE 04/09
DRAWN : BWH	04/09
TRACED : -	
CHECKED : 04/09	
SUBMITTED : APRIL 2009	
SCALE: AS SHOWN	

CAMARILLO SANITARY DISTRICT VENTURA COUNTY, CALIFORNIA	
CAMARILLO TERTIARY EFFLUENT PIPELINE INSTALLATION	
GENERAL NOTES, SYMBOLS AND ABBREVIATIONS	

JOB NO. SS-03-03
DRAWING NO. G02
SHEET NO. 2 OF 11



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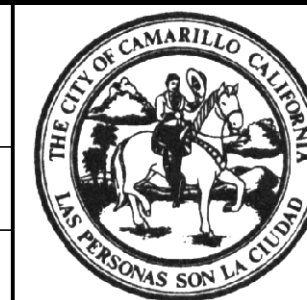
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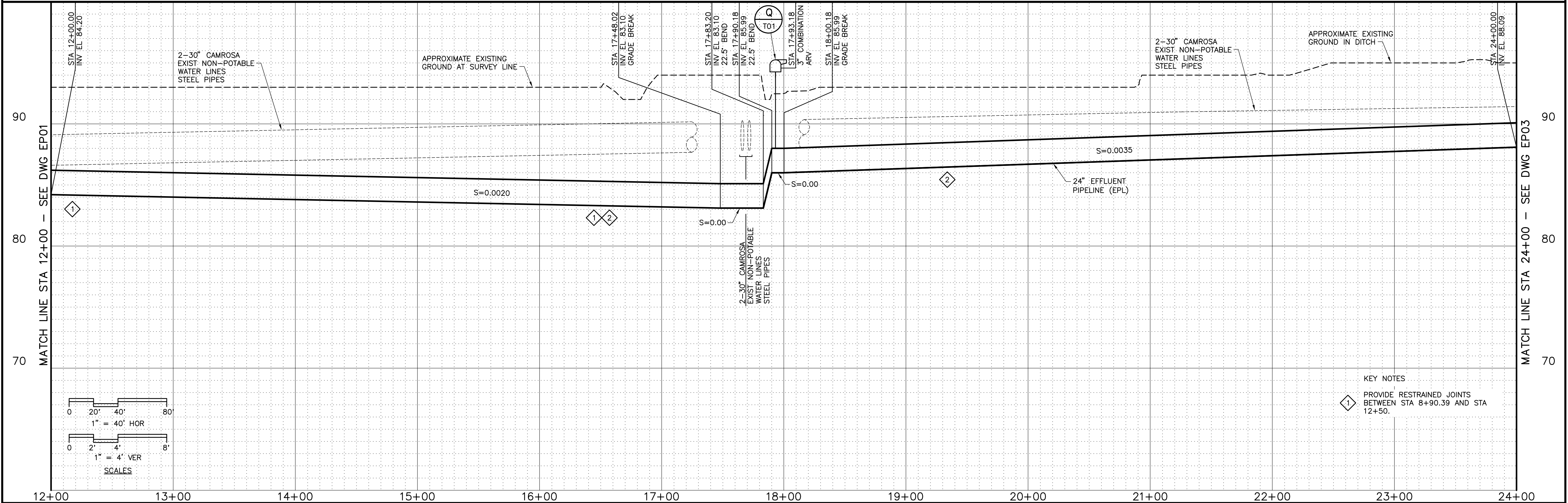
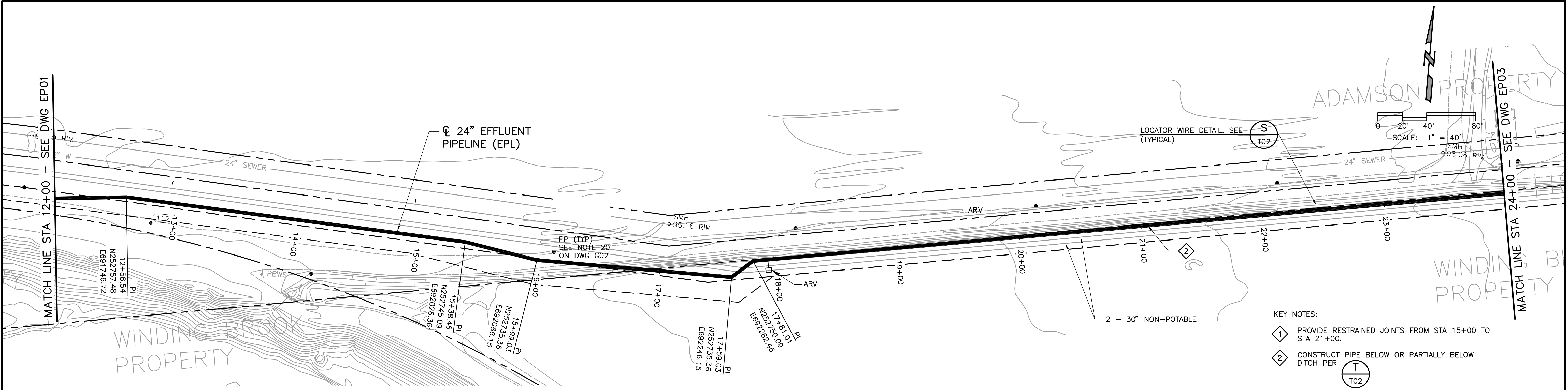


APPROVED: CITY OF CAMARILLO	
DEPUTY DIRECTOR/CITY ENGINEER RCE 50878	DATE 9-30-11
REVIEWED: WATER RECLAMATION SUPERINTENDENT	DATE
REVIEWED: DEPUTY DIRECTOR/ENVIRONMENTAL ENGINEER	DATE



DESIGNED : LJE	DATE 04/09
DRAWN : BWH	DATE 04/09
TRACED : -	DATE
CHECKED : 04/09	DATE
SUBMITTED : APRIL 2009	DATE
SCALE: AS SHOWN	

CAMARILLO SANITARY DISTRICT VENTURA COUNTY, CALIFORNIA		JOB NO. SS-03-03
CAMARILLO TERTIARY EFFLUENT PIPELINE INSTALLATION		DRAWING NO. EPO1
EFFLUENT PIPE PLAN AND PROFILE		SHEET NO. 3 OF 11
		C-15038



INSTALL PER 

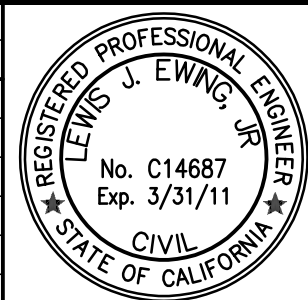
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NO.	DATE	INITIAL	DESCRIPTION	APP'VD

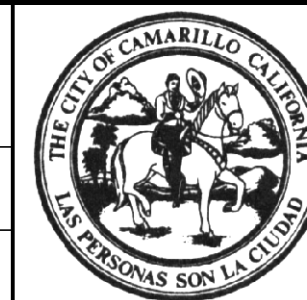


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DEPUTY DIRECTOR/CITY ENGINEER RCE 50878	DATE EXP 9-30-11
REVIEWED: WATER RECLAMATION SUPERINTENDENT	DATE
REVIEWED: DEPUTY DIRECTOR/ENVIRONMENTAL ENGINEER	DATE

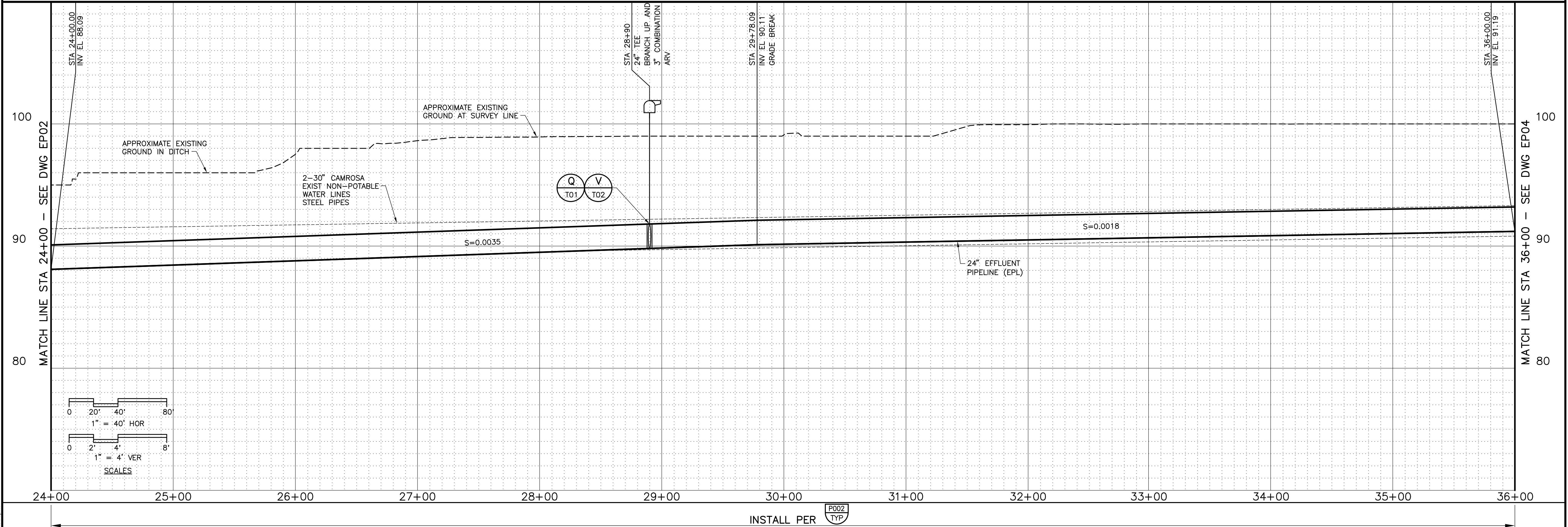
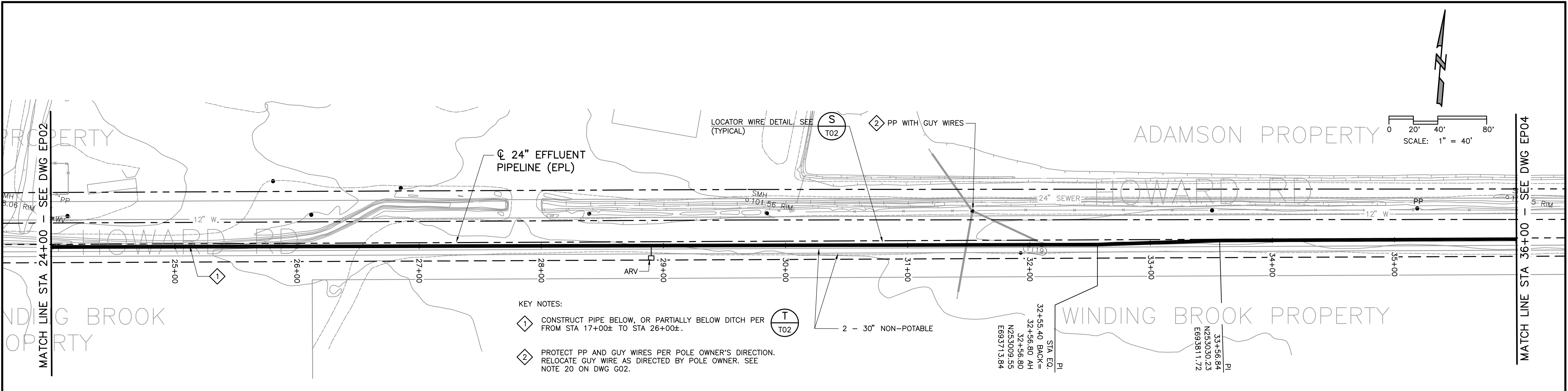


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DRAWN : BWH	04/09
TRACED : -	-
CHECKED : 04/09	04/09
SUBMITTED : APRIL 2009	APRIL 2009
SCALE: AS SHOWN	

CAMARILLO SANITARY DISTRICT VENTURA COUNTY, CALIFORNIA		JOB NO. SS-03-03
CAMARILLO TERTIARY EFFLUENT PIPELINE INSTALLATION		DRAWING NO. EP02
EFFLUENT PIPE PLAN AND PROFILE		SHEET NO. 4 OF 11
		C-15039

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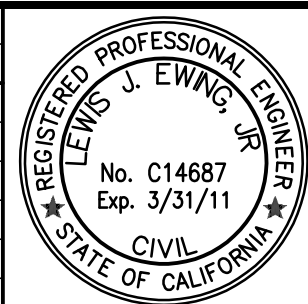
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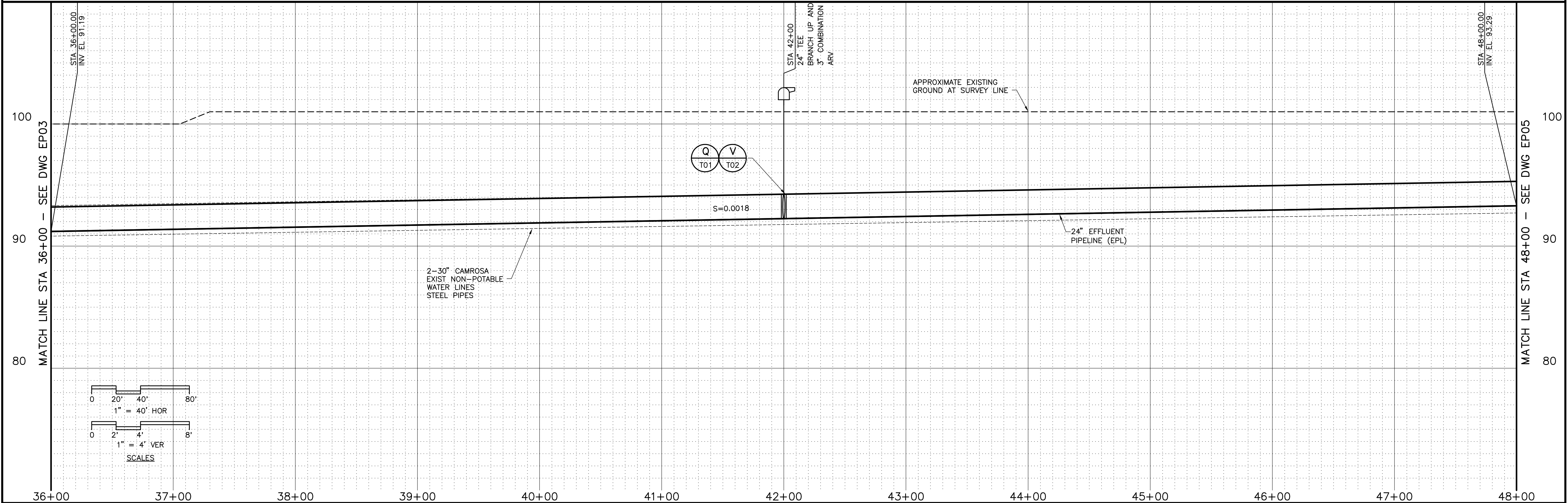
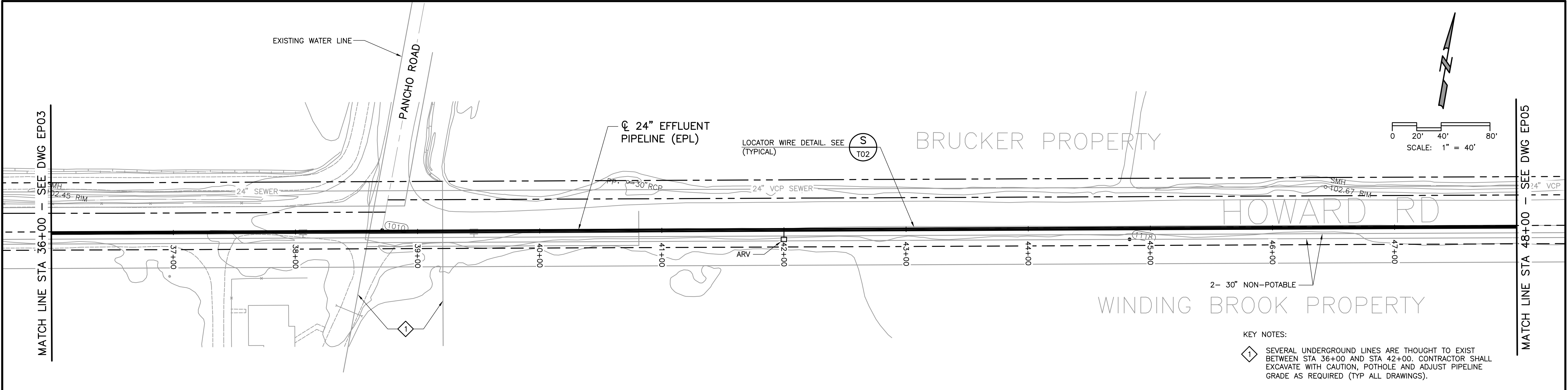



APPROVED: CITY OF CAMARILLO	
DEPUTY DIRECTOR/CITY ENGINEER	DATE
RCE 50878	EXP 9-30-11
REVIEWED:	
WATER RECLAMATION SUPERINTENDENT	DATE
REVIEWED:	
DEPUTY DIRECTOR/ENVIRONMENTAL ENGINEER	DATE



DESIGNED :	LJE	DATE	04/09
DRAWN :	BWH	DATE	04/09
TRACED :	-		
CHECKED :		DATE	04/09
SUBMITTED :	APRIL 2009		
SCALE: AS SHOWN			


CAMARILLO SANITARY DISTRICT		JOB NO.	SS-03-03
VENTURA COUNTY, CALIFORNIA		DRAWING NO.	EP03
CAMARILLO TERTIARY EFFLUENT PIPELINE INSTALLATION		SHEET NO.	5 OF 11
EFFLUENT PIPE PLAN AND PROFILE			C-15040






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DEPUTY DIRECTOR/CITY ENGINEER
RCE 50878 EXP 9-30-11
DATE
REVIEWED: WATER RECLAMATION SUPERINTENDENT
DATE
REVIEWED: DEPUTY DIRECTOR/ENVIRONMENTAL ENGINEER
DATE

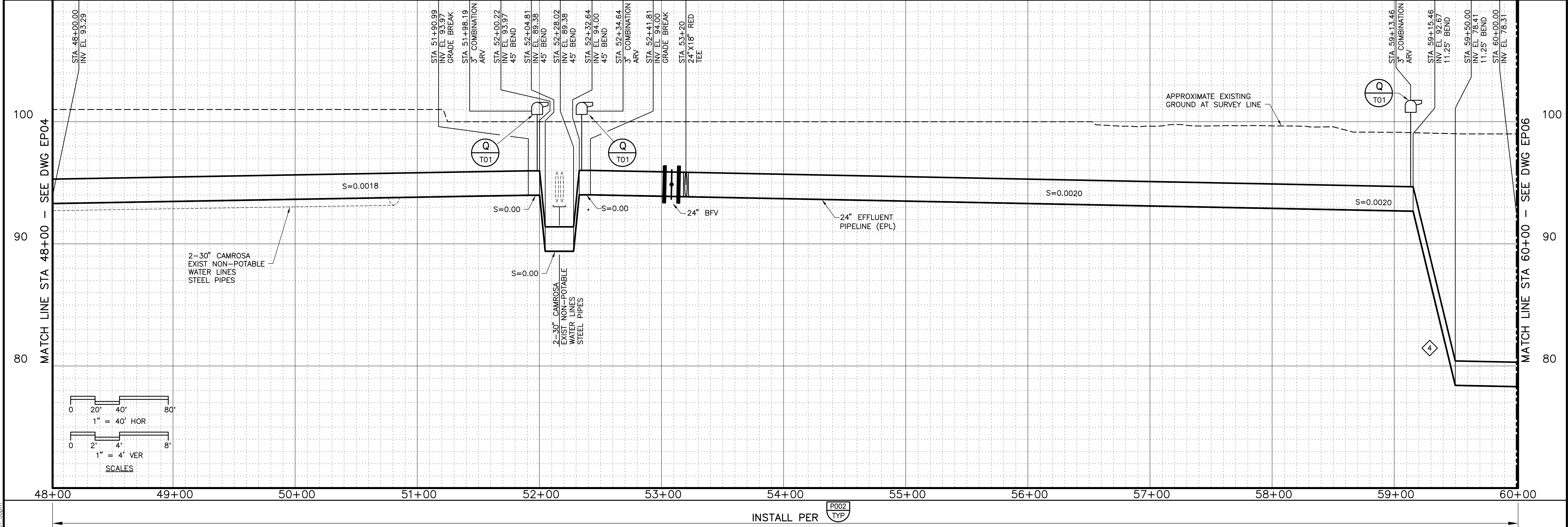
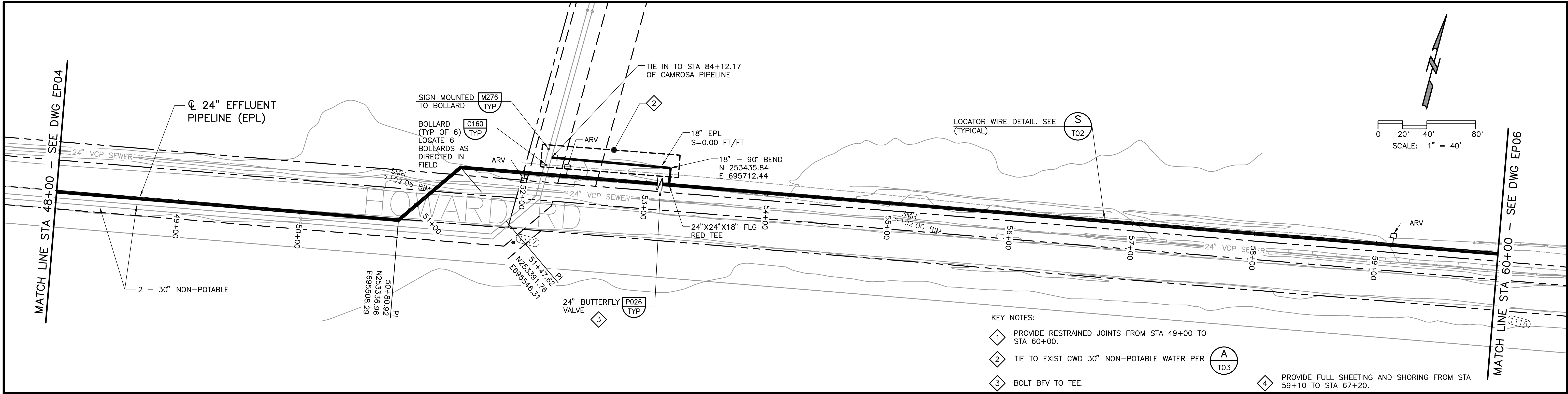


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SUBMITTED : APRIL 2009
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CAMARILLO SANITARY DISTRICT
VENTURA COUNTY, CALIFORNIA
CAMARILLO TERTIARY EFFLUENT PIPELINE INSTALLATION
EFFLUENT PIPE
PLAN AND PROFILE

JOB NO.
SS-03-03
DRAWING NO.
EP04
SHEET NO.
6 OF 11
C-15041

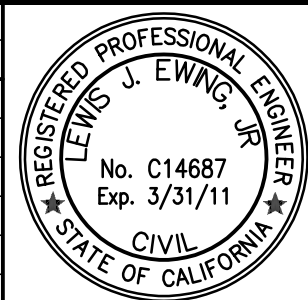
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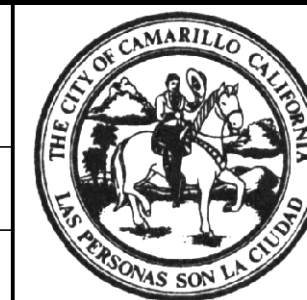


APPROVED: CITY OF CAMARILLO

DEPUTY DIRECTOR/CITY ENGINEER RCE 50878 EXP 9-30-11 DATE

REVIEWED: WATER RECLAMATION SUPERINTENDENT DATE

REVIEWED: DEPUTY DIRECTOR/ENVIRONMENTAL ENGINEER DATE



DESIGNED : LJE DATE 04/09

DRAWN : BWH DATE 04/09

TRACED : -

CHECKED : 04/09

SUBMITTED : APRIL 2009

SCALE: AS SHOWN

CAMARILLO SANITARY DISTRICT
VENTURA COUNTY, CALIFORNIA

CAMARILLO TERTIARY EFFLUENT PIPELINE INSTALLATION

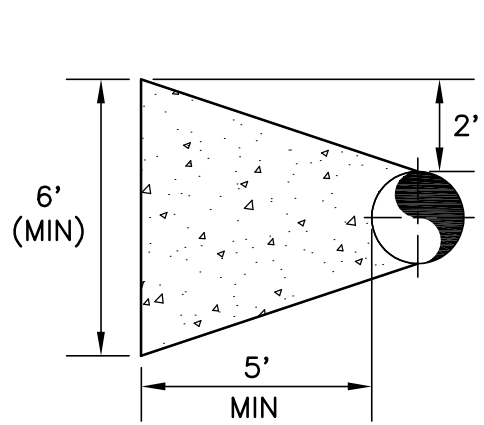
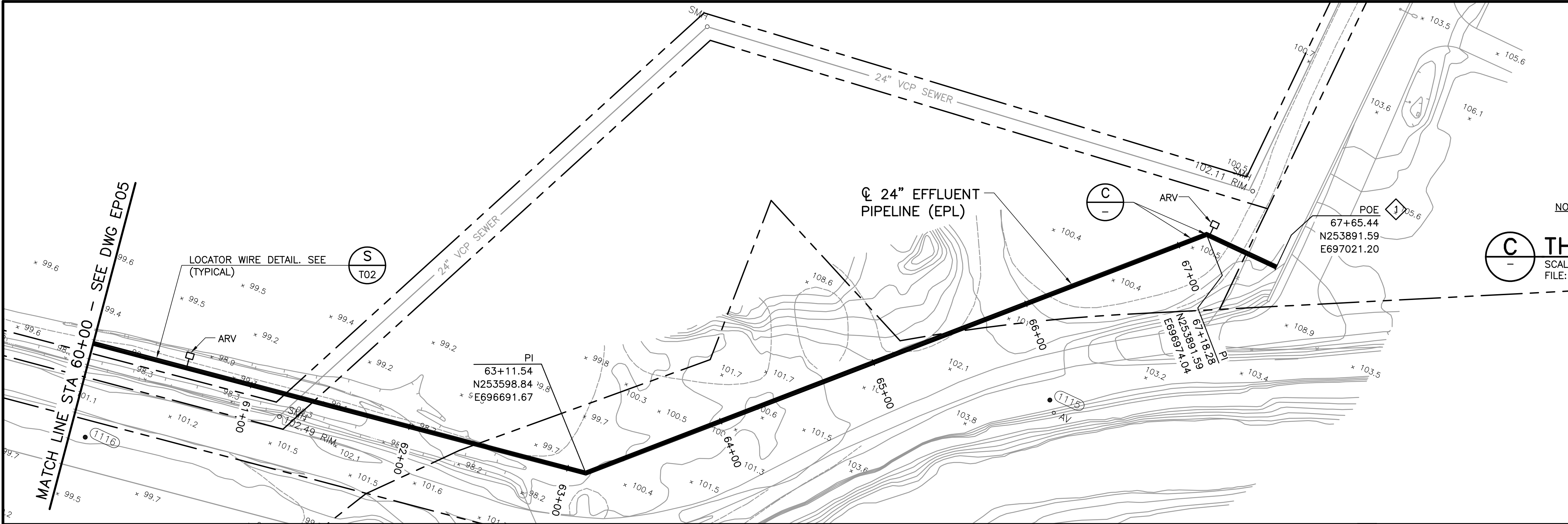
EFFLUENT PIPE PLAN AND PROFILE

JOB NO. SS-03-03

DRAWING NO. EP05

SHEET NO. 7 OF 11

C-15042



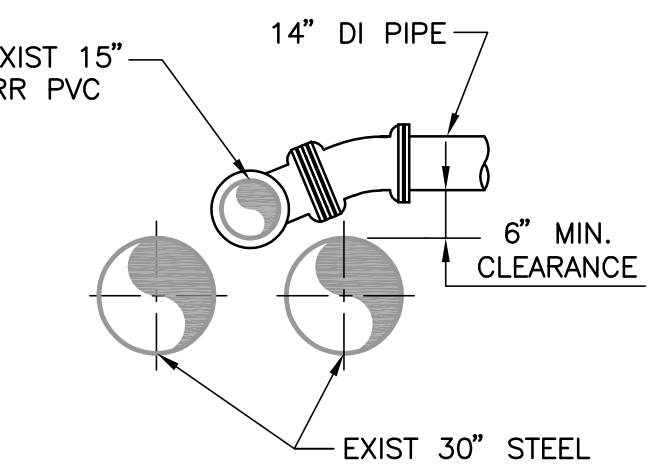
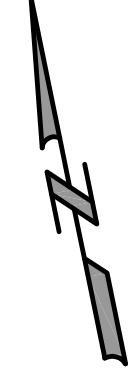
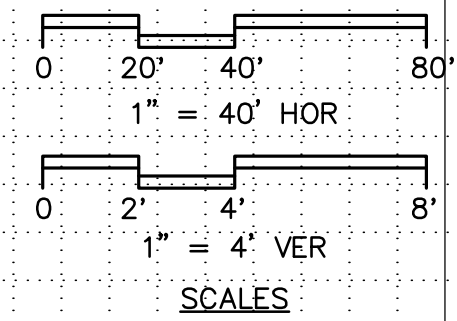
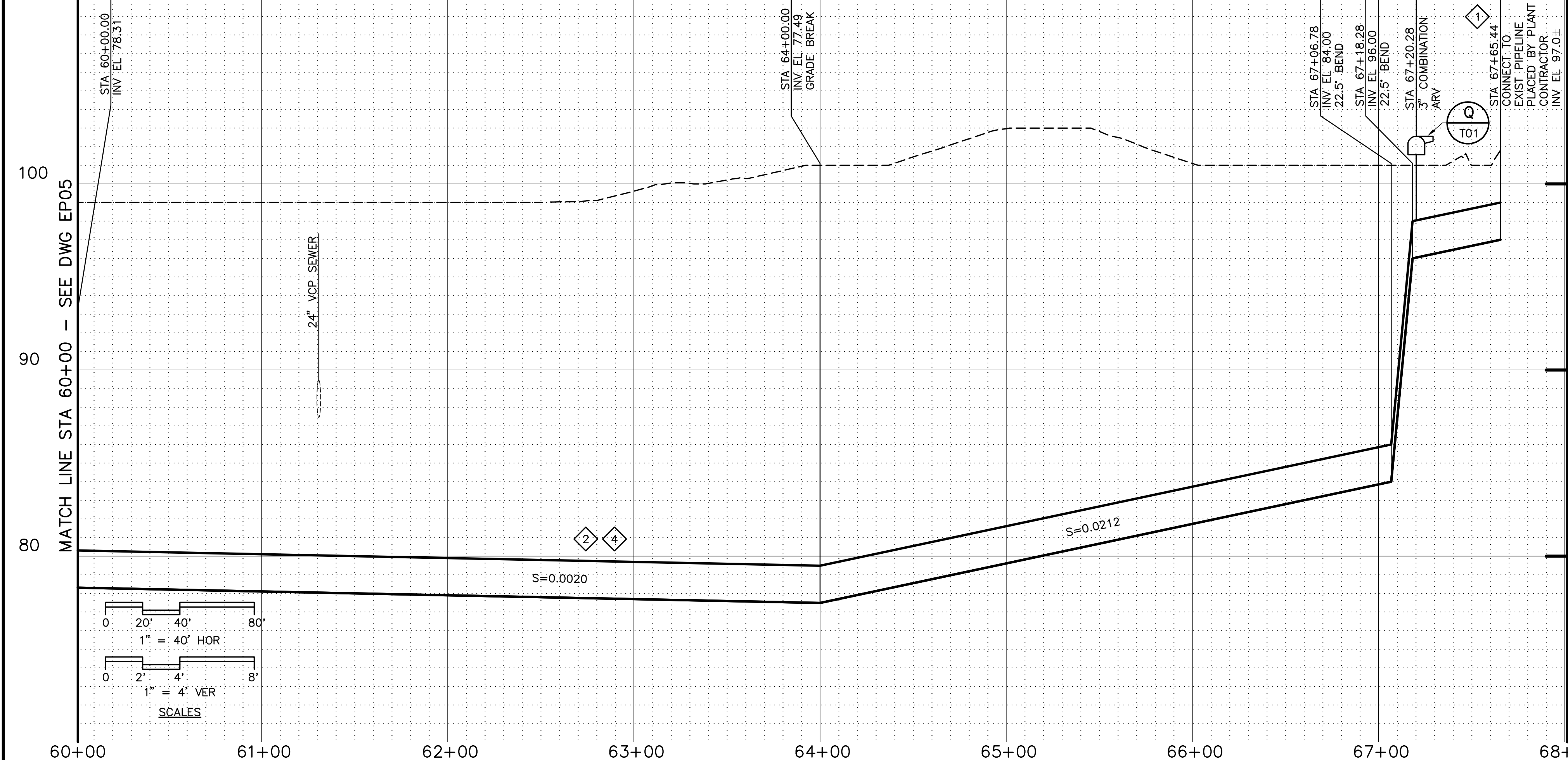
NOTE: THRUST BLOCKS TO BE PLACED AT STA 67+07 AND STA 67+18 (7' MIN LENGTH)

C THRUST BLOCK SECTION

SCALE: NTS
FILE: 6086-C-300

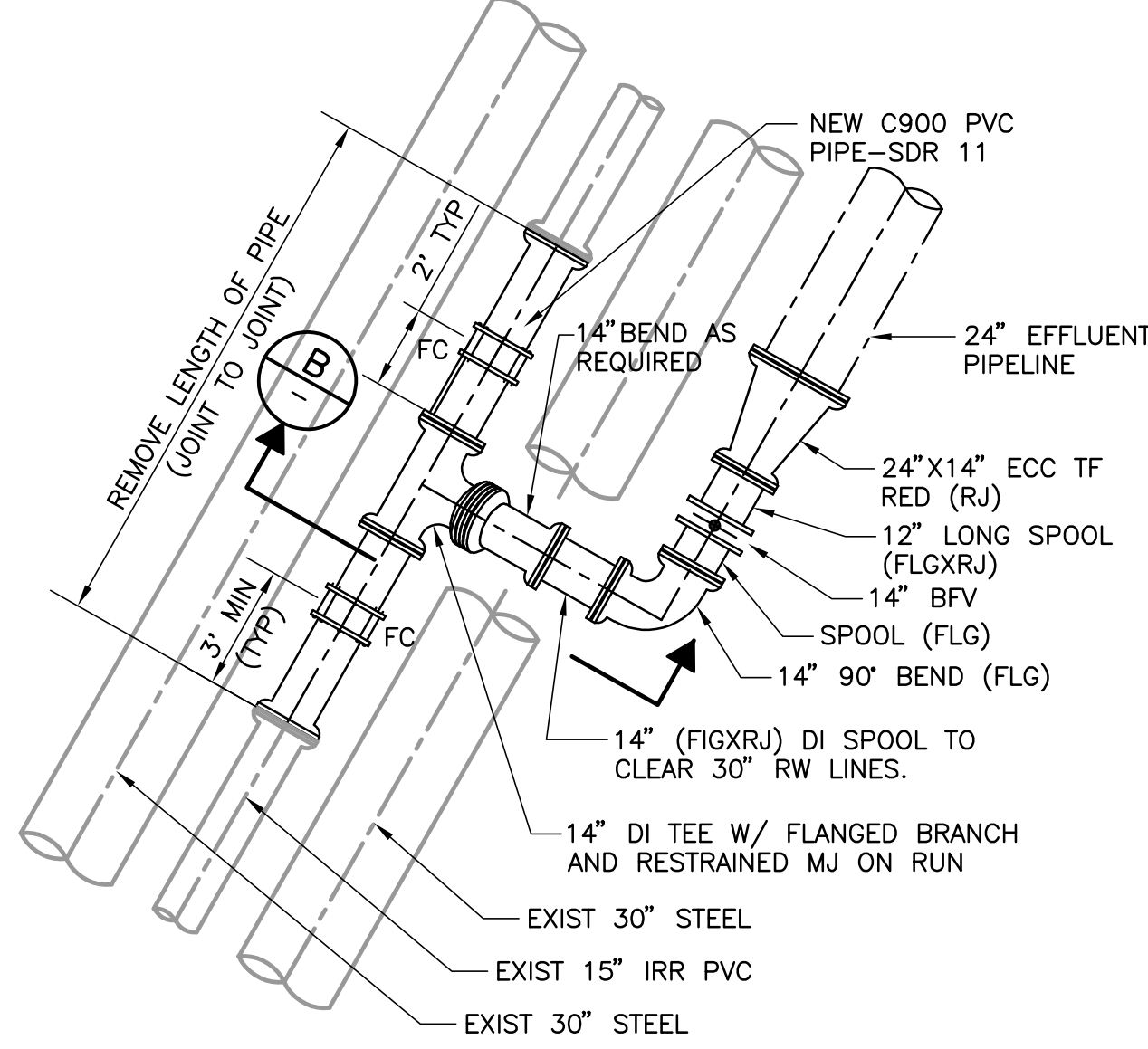
KEY NOTES:

- 1 LOCATE EXISTING PIPE, DETERMINE TYPE OF CONNECTION REQUIRED, DRAIN WATER FROM PIPE, REMOVE END CLOSURE AND CONNECT TO PIPE WITH ENGINEER'S APPROVED JOINT.
- 2 PROVIDE RESTRAINED JOINTS FROM STA 60+00 TO STA 67+65.44
- 3 WATER FROM DEWATERING OPERATIONS SHALL BE DISPOSED OF AT THE CAMARILLO SANITARY DISTRICT'S WASTEWATER TREATMENT PLANT, SEE NOTE 21 ON DWG 602.
- 4 PROVIDE FULL SHEETING AND SHORING FROM STA 59+10 TO STA 67+20.



B SECTION

SCALE: NTS
FILE: 6086-C-300



NOTES:

1. LOCATE JOINT ALONG EXISTING PIPE AND ADJUST LOCATION OF NEW TEE.
2. REMOVE ONE LENGTH OF PIPE (JOINT TO JOINT).
3. INSTALL TEE IN NEW LENGTH OF PIPE - REPLACE GASKETS.
4. ROLL TEE UP TO CLEAR EXISTING 30" RW LINE.

A CUTOUT DETAIL

EP01 SCALE: NTS
FILE: 6086-C-300

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NO.	DATE	INITIAL	DESCRIPTION	APP'VD



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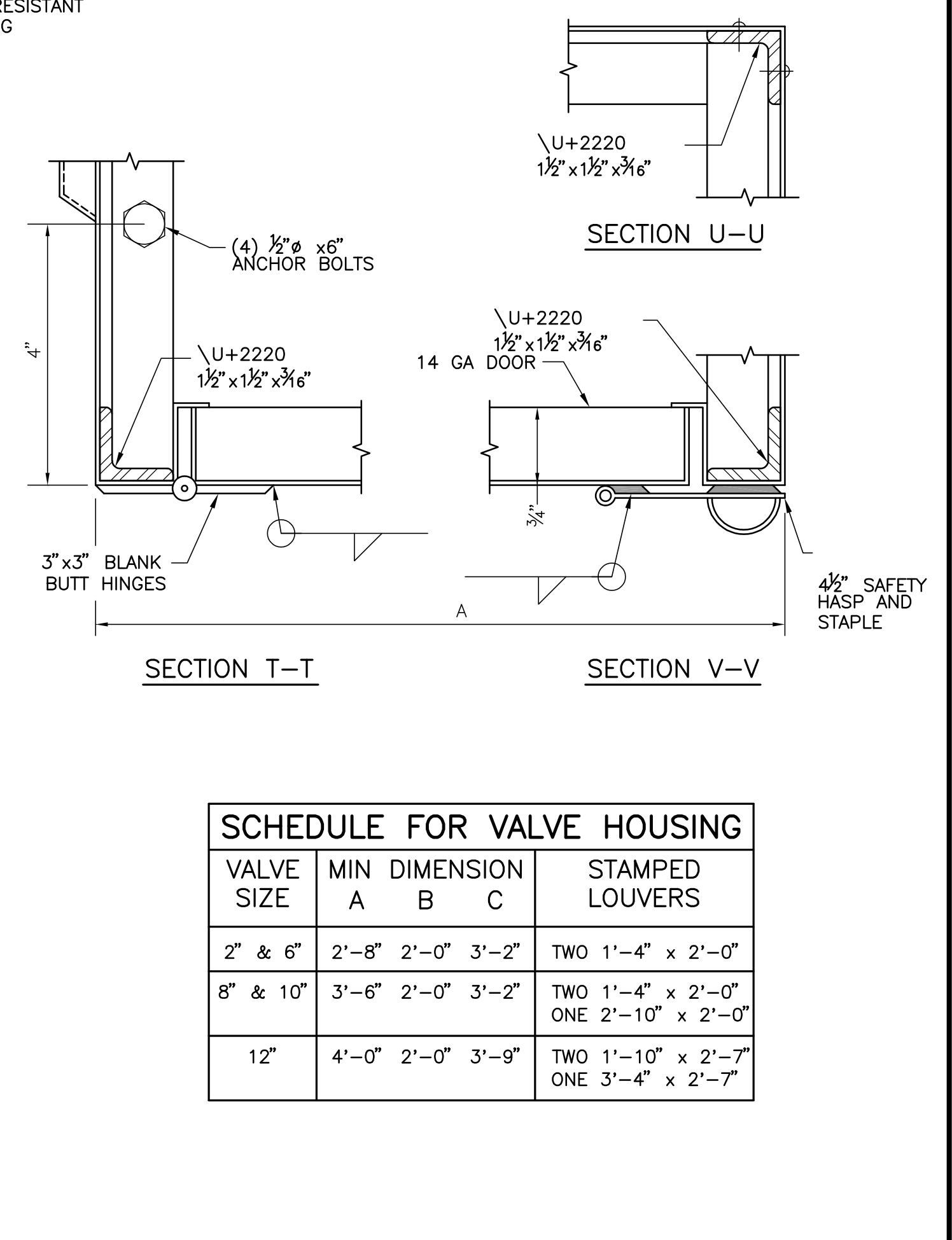
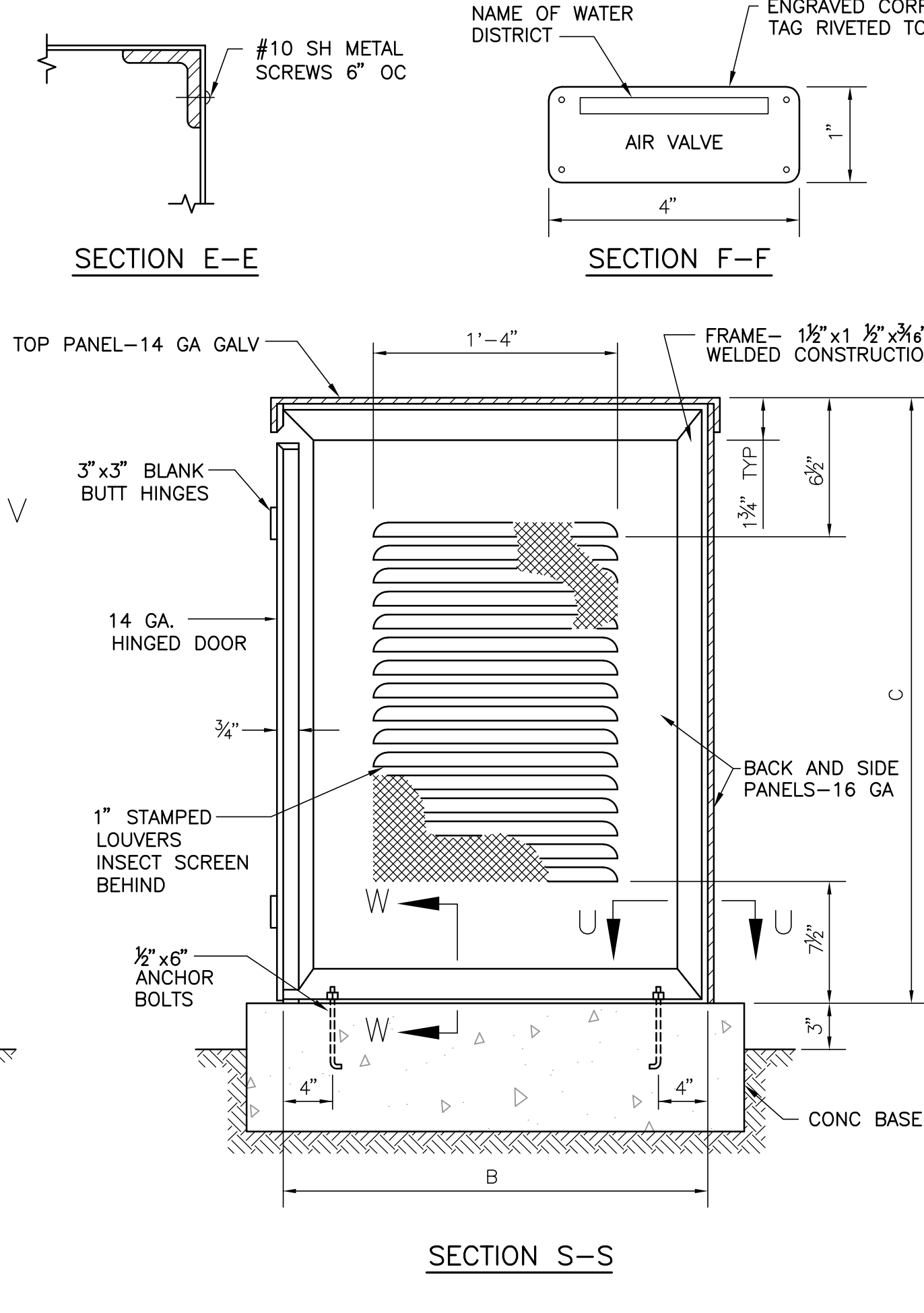
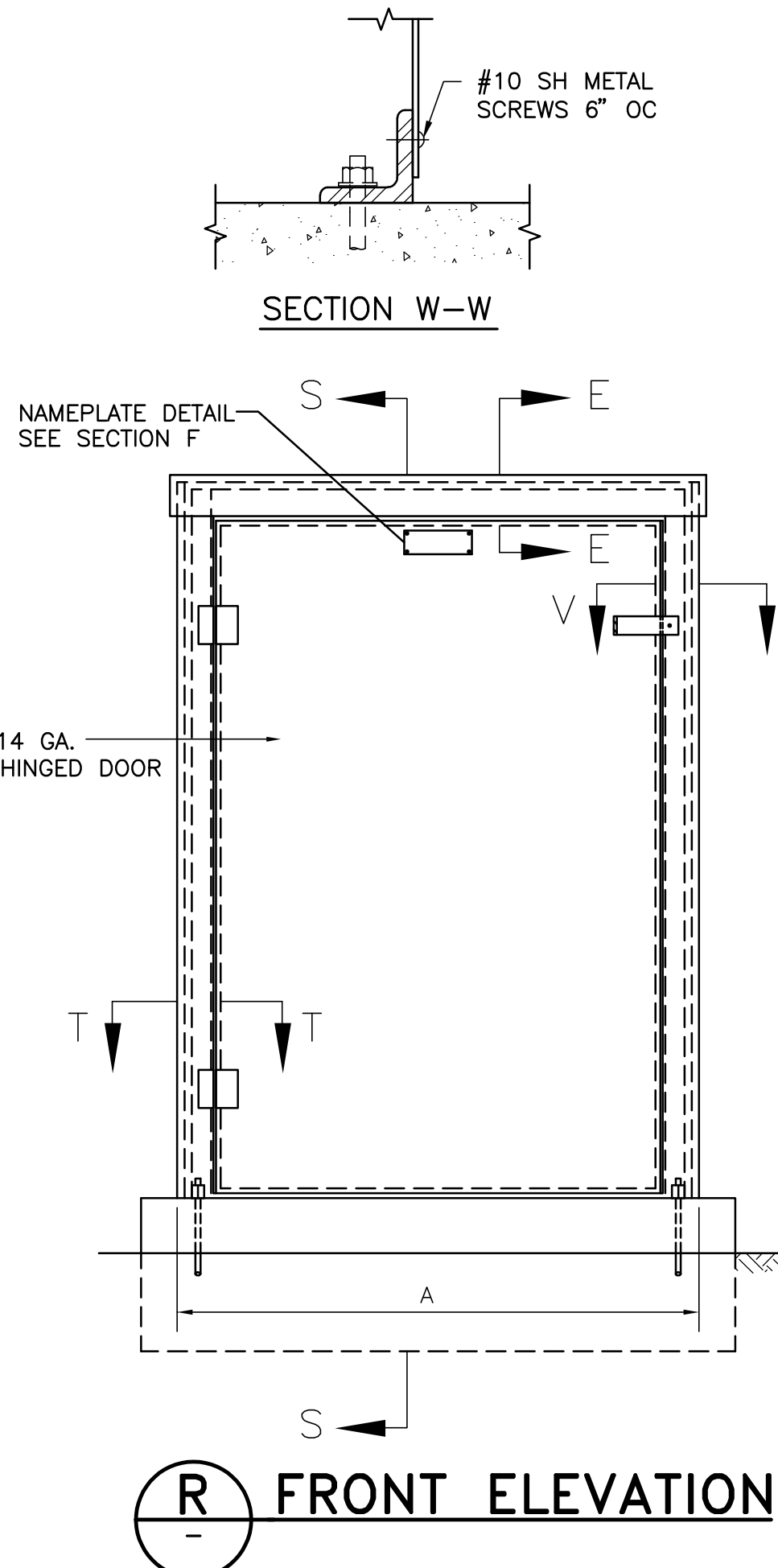
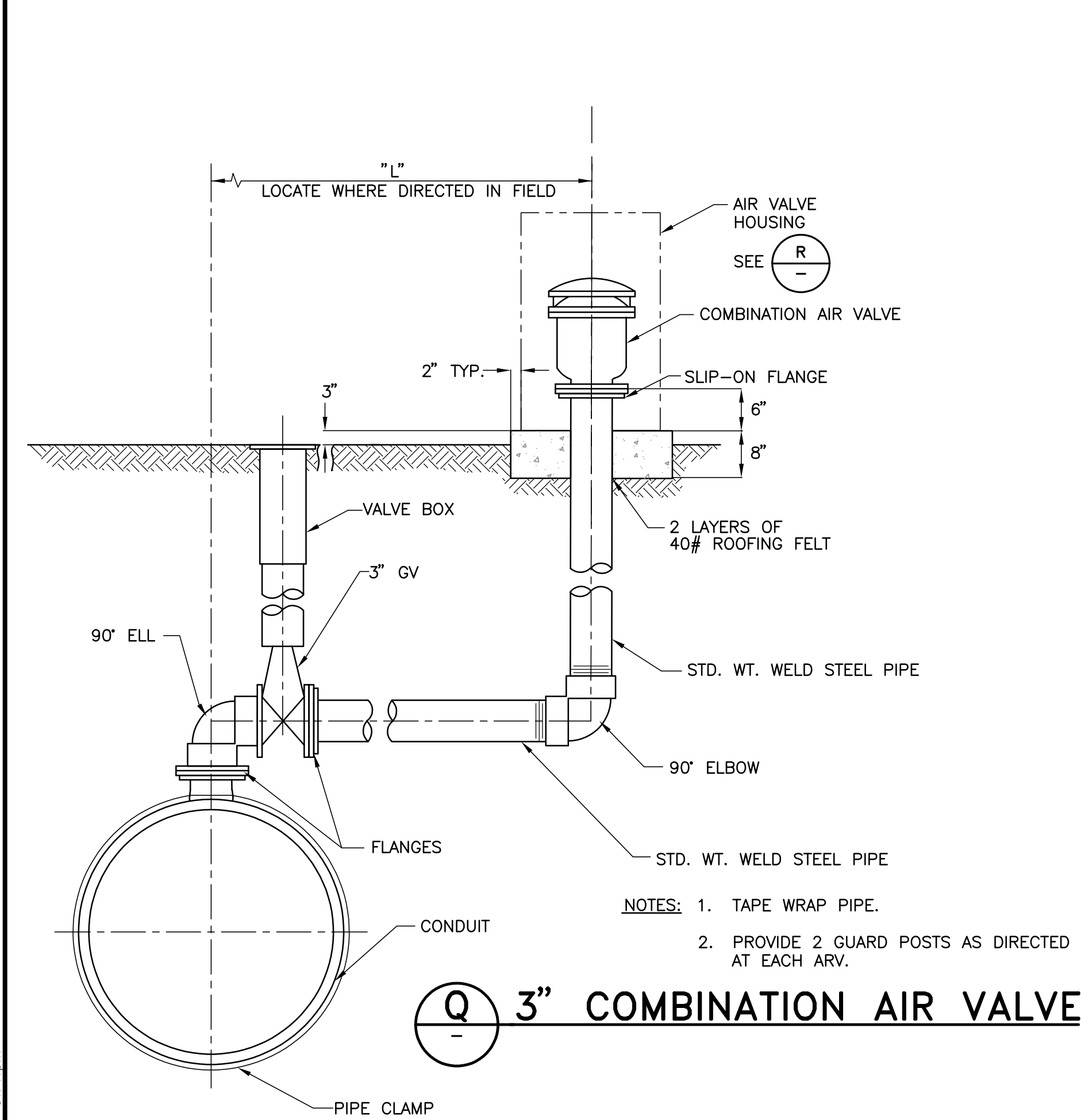
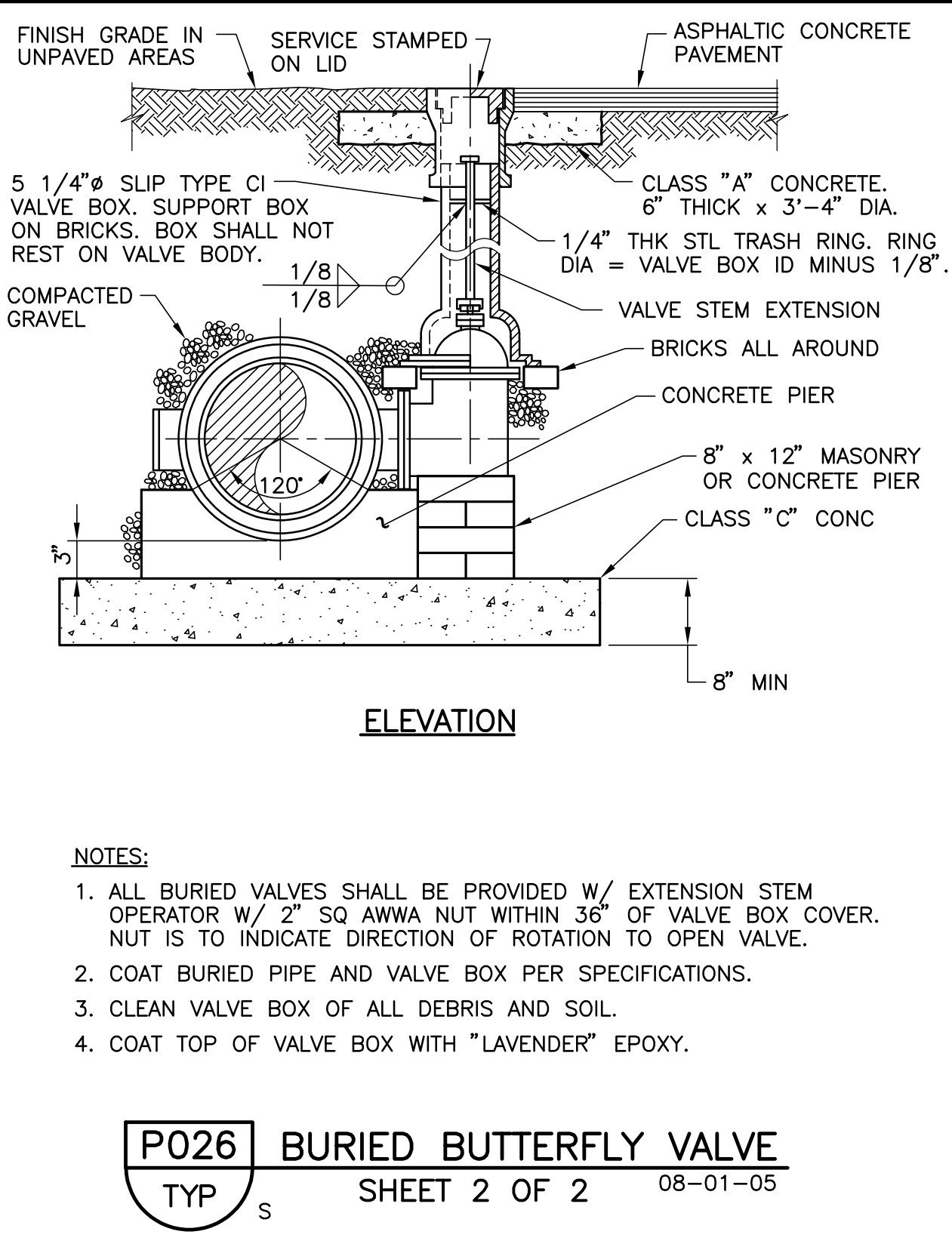
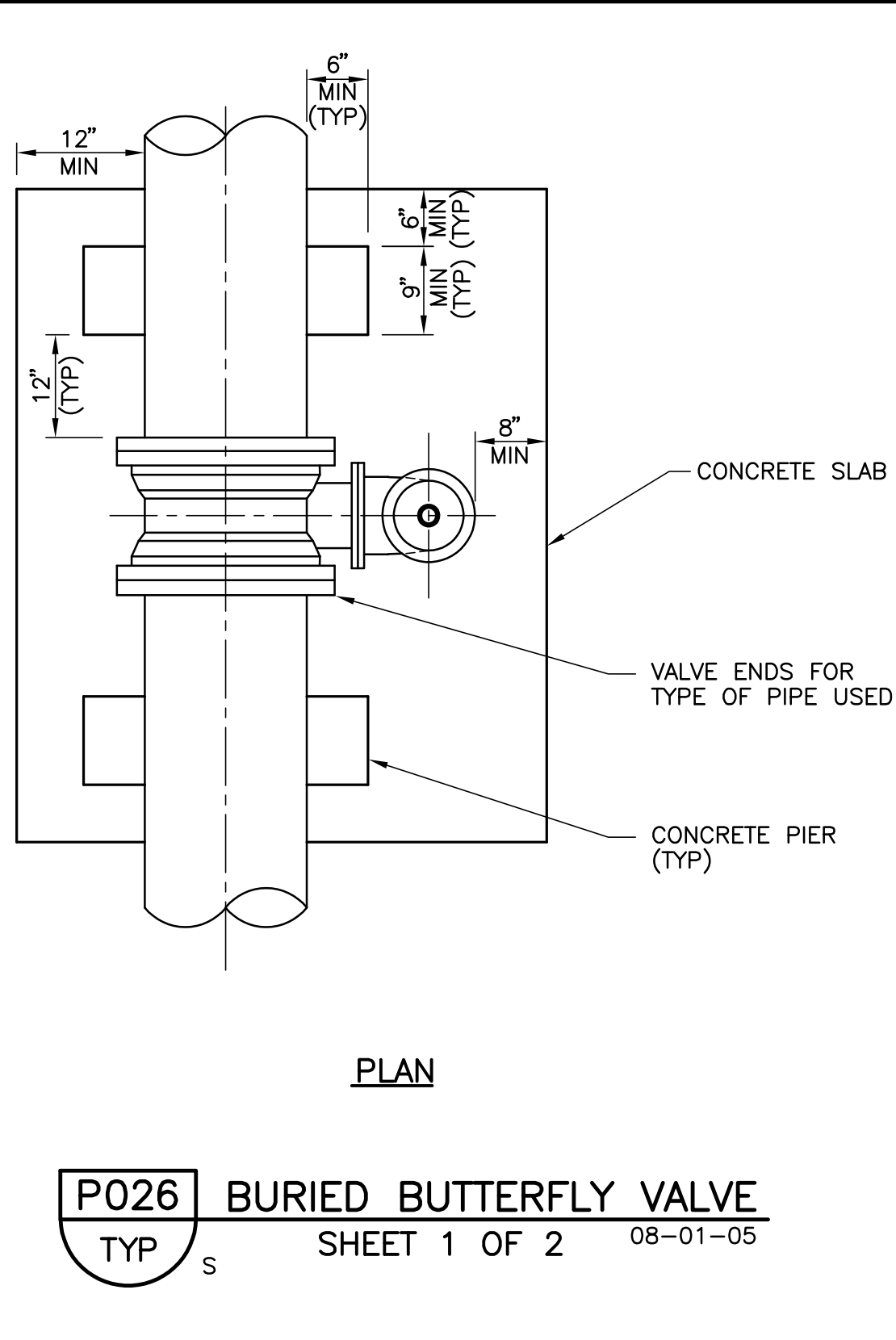
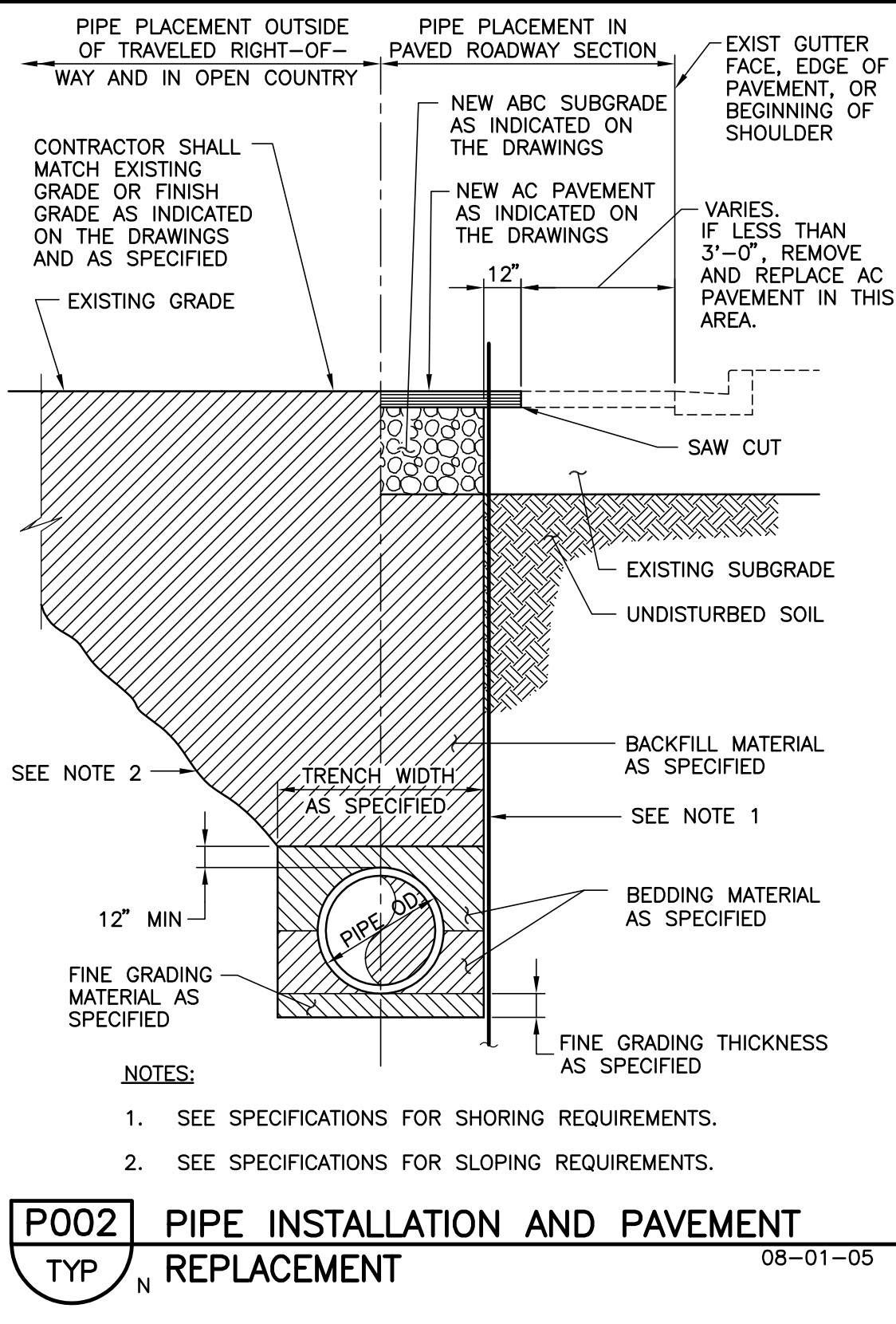
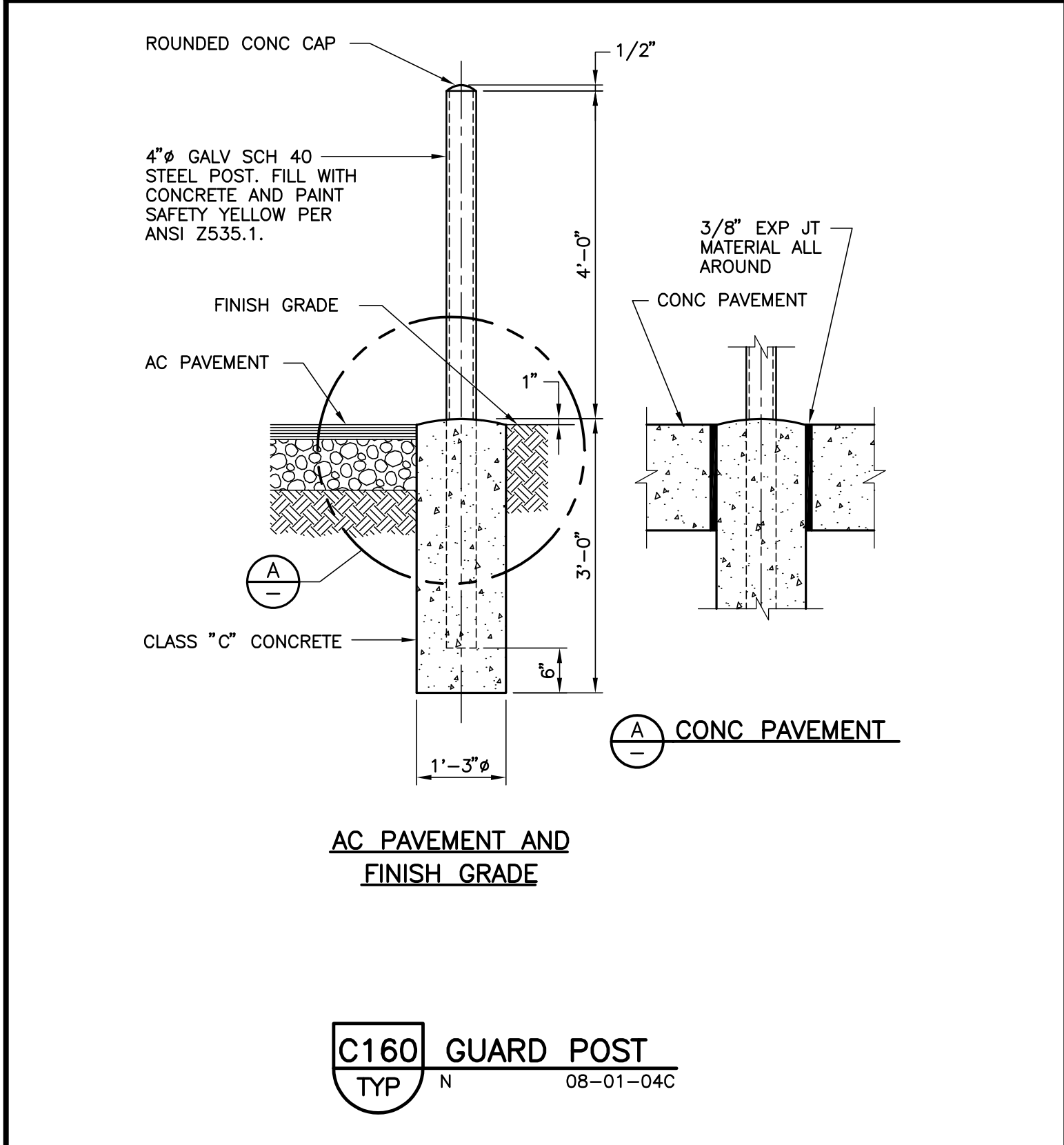
APPROVED: CITY OF CAMARILLO	
DEPUTY DIRECTOR/CITY ENGINEER RCE 50878 EXP 9-30-11	DATE
REVIEWED:	
WATER RECLAMATION SUPERINTENDENT	DATE
REVIEWED:	
DEPUTY DIRECTOR/ENVIRONMENTAL ENGINEER	DATE



DESIGNED : LJE	DATE 04/09
DRAWN : BWH	04/09
TRACED : -	
CHECKED : 04/09	
SUBMITTED : APRIL 2009	
SCALE: AS SHOWN	

CAMARILLO SANITARY DISTRICT VENTURA COUNTY, CALIFORNIA		JOB NO. SS-03-03
CAMARILLO TERTIARY EFFLUENT PIPELINE INSTALLATION		DRAWING NO. EP06
EFFLUENT PIPE PLAN AND PROFILE		SHEET NO. 8 OF 11
		C-15043

Let Saved By: T:\S 12-27-09 03:09pm



SCHEDULE FOR VALVE HOUSING				
VALVE SIZE	MIN DIMENSION A	B	C	STAMPED LOUVERS
2" & 6"	2'-8"	2'-0"	3'-2"	TWO 1'-4" x 2'-0"
8" & 10"	3'-6"	2'-0"	3'-2"	TWO 1'-4" x 2'-0" ONE 2'-10" x 2'-0"
12"	4'-0"	2'-0"	3'-9"	TWO 1'-10" x 2'-7" ONE 3'-4" x 2'-7"

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REVISIONS				
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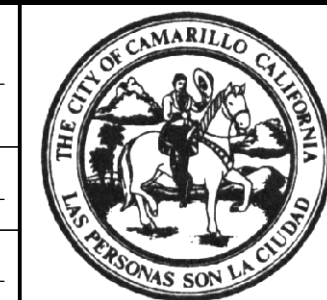


APPROVED: CITY OF CAMARILLO

DEPUTY DIRECTOR/CITY ENGINEER RCE 50878 EXP 9-30-11 DATE

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DESIGNED: LJE DATE 04/09

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TRACED: -

CHECKED: 04/09

SUBMITTED: APRIL 2009

SCALE: AS SHOWN

CAMARILLO SANITARY DISTRICT

VENTURA COUNTY, CALIFORNIA

CAMARILLO TERTIARY EFFLUENT PIPELINE INSTALLATION

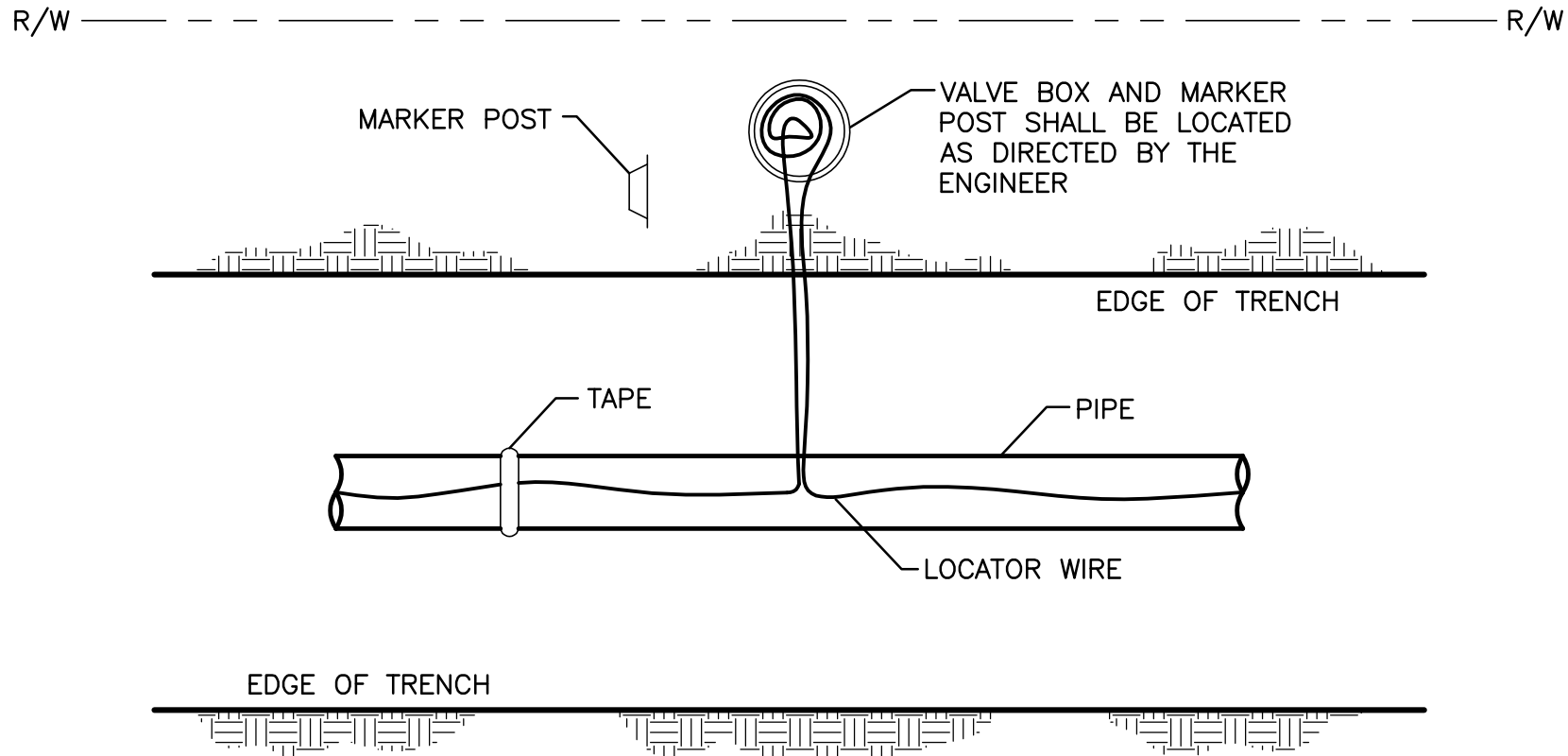
DETAILS

JOB NO. SS-03-03

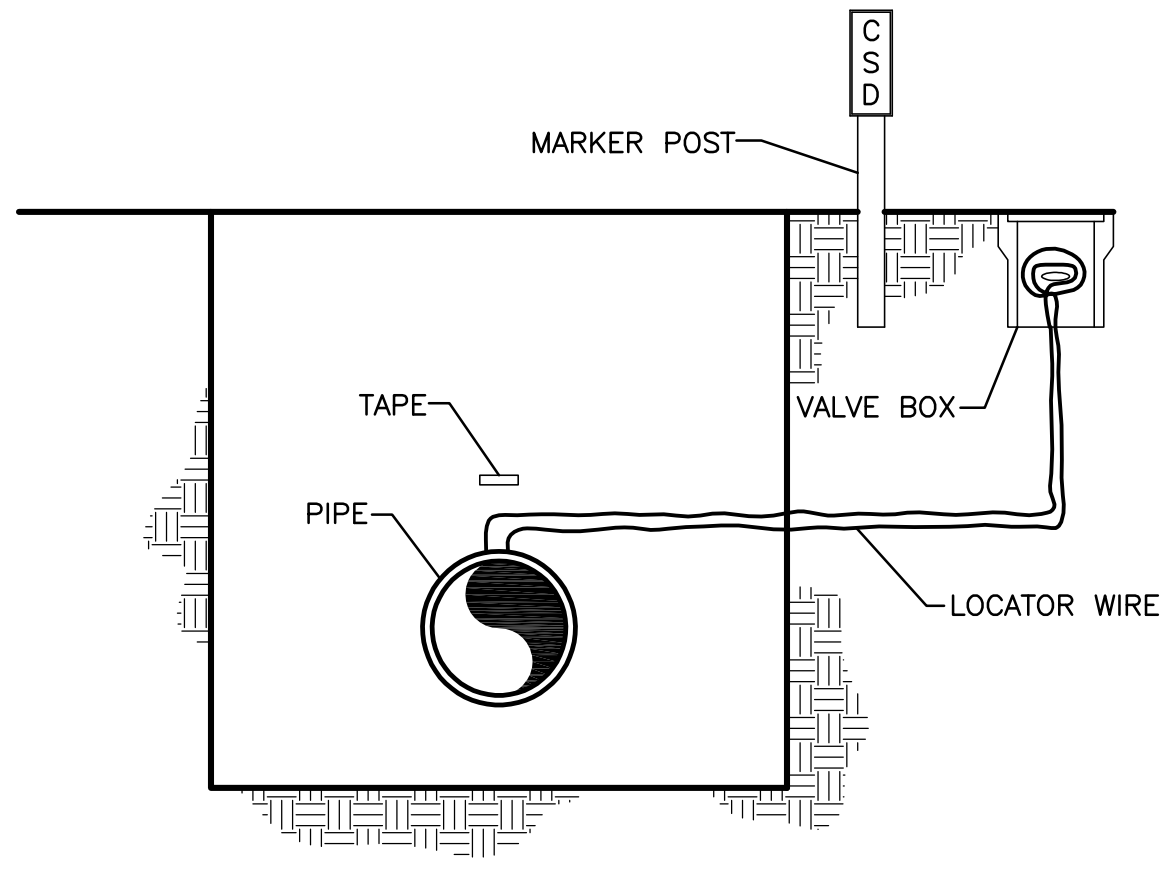
DRAWING NO. T01

SHEET NO. 9 OF 11

C-15044



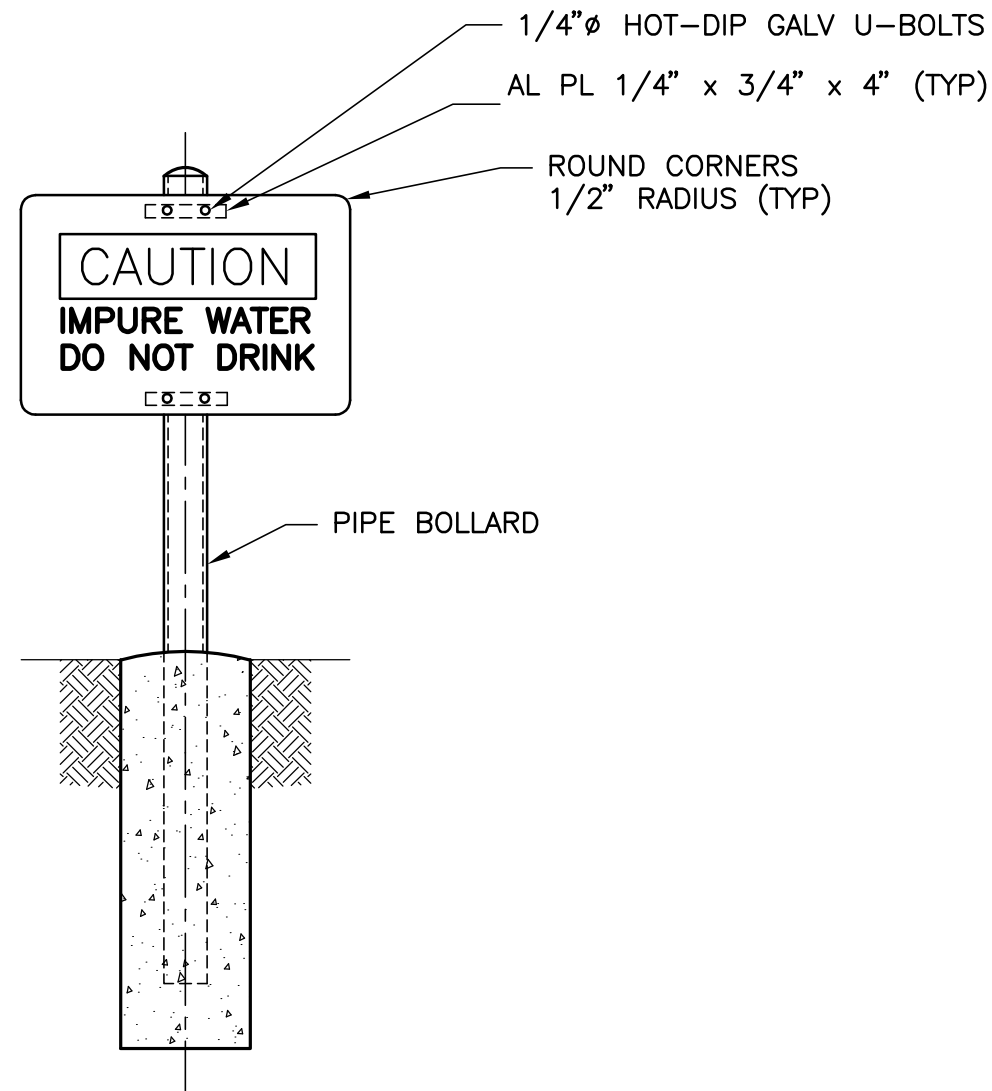
PLAN VIEW



TYPICAL TRENCH SECTION

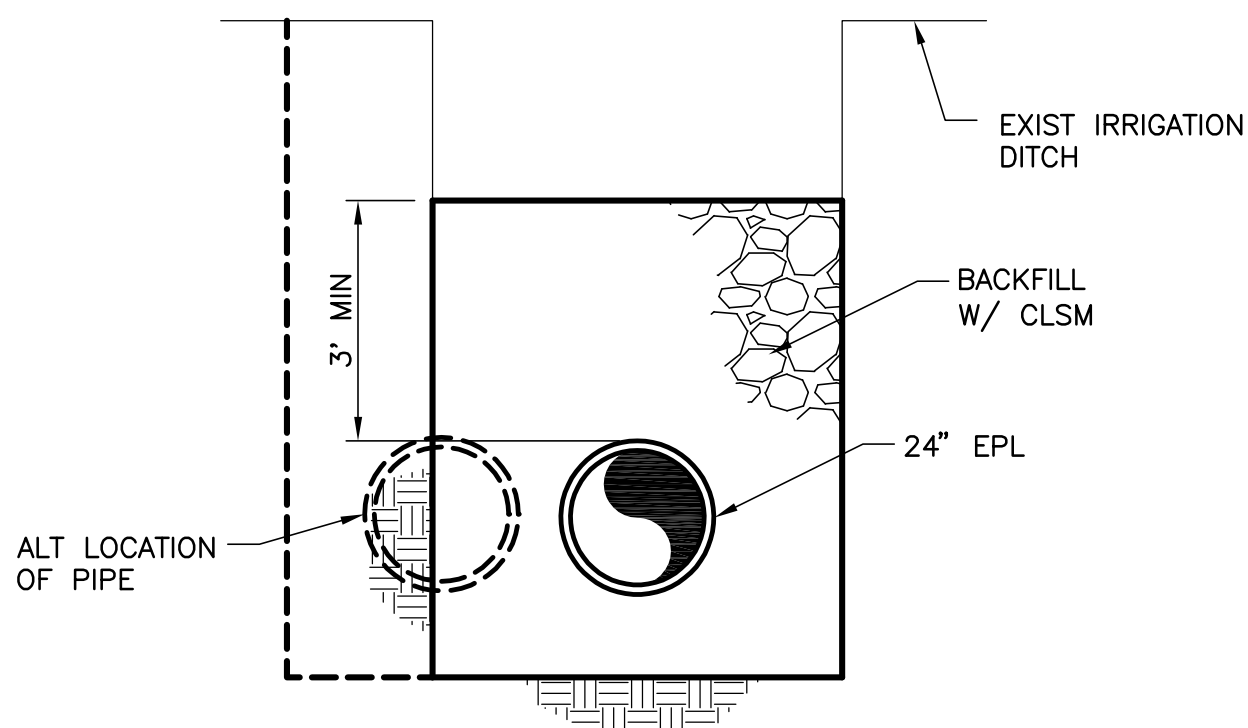
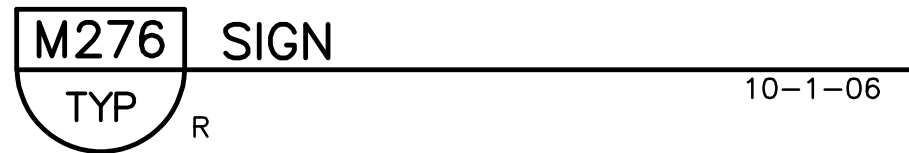
1. LOCATOR WIRE TO BE 14 GAUGE SOLID COPPER UF, THWN, OR THHN.
2. LOCATOR WIRE SHALL BE BROUGHT TO THE SURFACE AT 500 FT MAX.
3. LOOP 2 FEET OF WIRE IN VALVE BOX.
4. WIRE TO BE CONTINUOUS STRAND.
5. LOCATOR WIRE SHALL BE INSTALLED OVER RECYCLED WATERLINES.
6. USE CAST IRON COVER LABELED RECYCLED. (PAINTED LAVENDER)
7. LOCATOR TAPE SHALL BE INSTALLED 12 INCHES ABOVE PIPE.
8. FOR PIPE DEPTHS GREATER THAN 6 FT, LOCATOR WIRE SHALL BE PLACED ABOVE PIPE AT MAX 6 FT DEPTH. MARKER TAPE SHALL BE PLACED 1 FT ABOVE THE LOCATOR WIRE.
9. A LOCATIBILITY TEST IS TO BE PERFORMED ON ALL LOCATOR WIRES.
10. SPLICES TO BE DONE WITH A CRIMPABLE BUTT CONNECTOR.
11. MARKER POST SHALL BE FLEXIBLE WHITE PLASTIC SHAPES WITH TOP SET 30 INCHES ABOVE GROUND. LOCATE AS DIRECTED.

S LOCATOR WIRE DETAIL



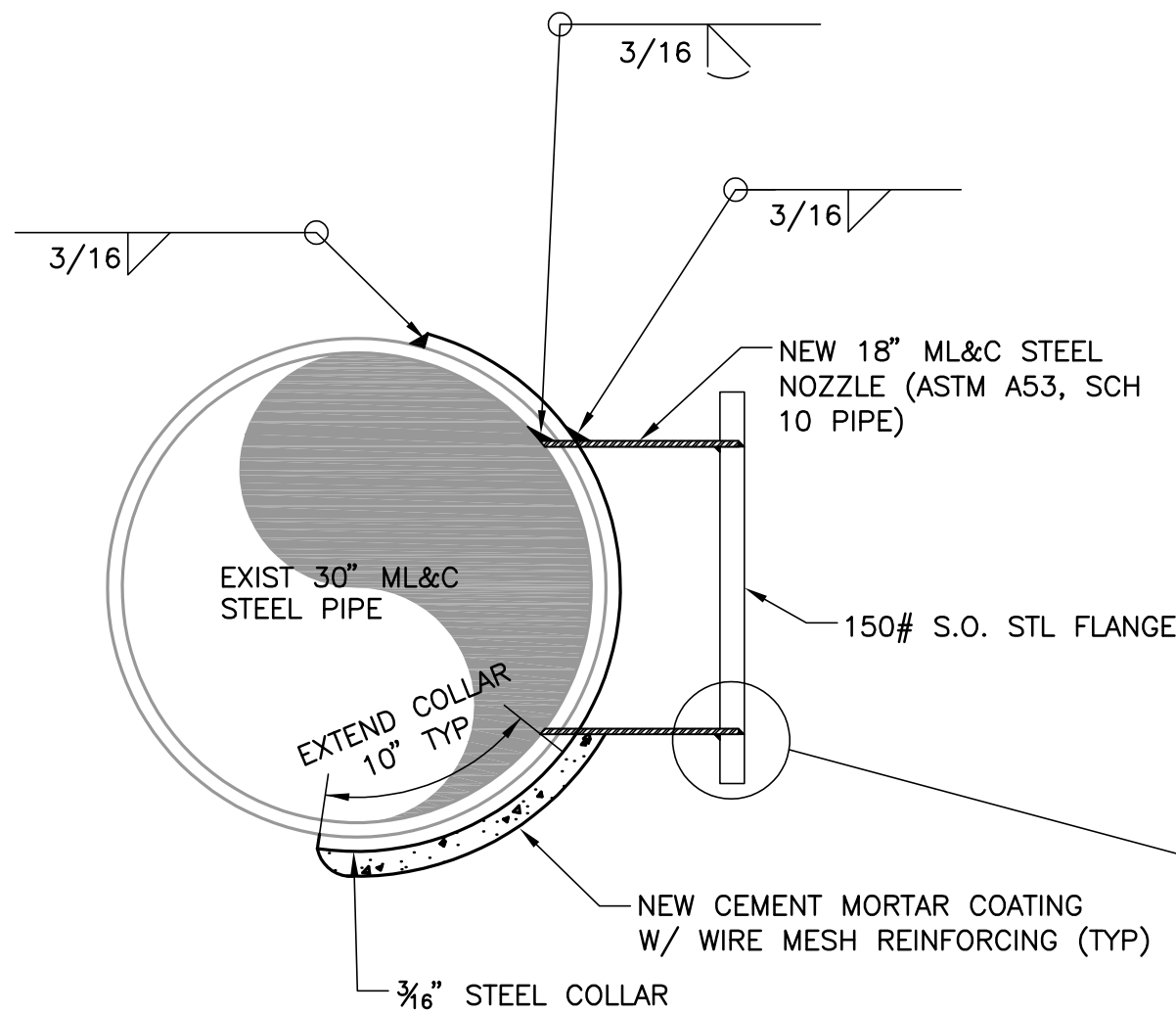
NOTES:

1. SIGN SHALL BE 3/8" THICK PLASTIC RESISTANT TO SUNLIGHT (ULTRAVIOLET) DETERIORATION.
2. SIGN SHALL BE 7" x 10" MIN AND SHALL CONFORM TO THE SPECIFICATIONS.
3. MOUNT SIGN TO PIPE BOLLARD.
4. PROVIDE ONE SIGN AT EACH ARV AND ONE AT THE PRESSURE REGULATION STATION NEAR STA 53+00.



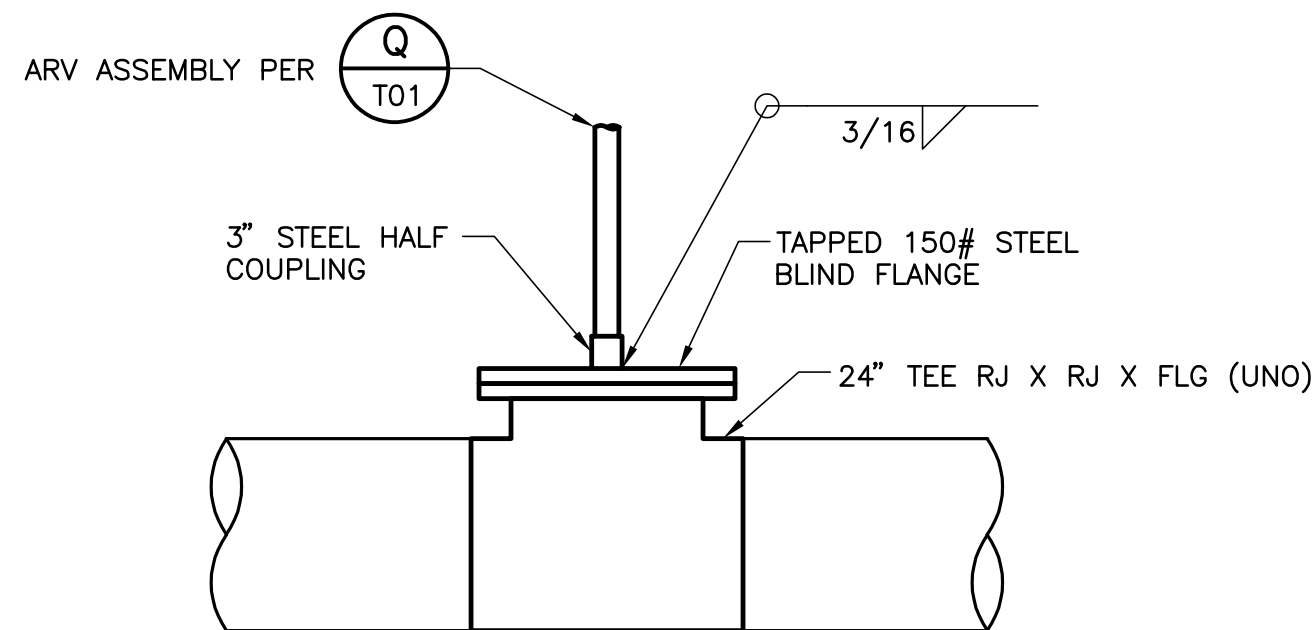
AFTER INSTALLATION OF PIPE, RECONSTRUCT IRRIGATION DITCH TO ORIGINAL SHAPE AND DEPTH.

T DITCH DETAIL



1. REMOVE EXIST CEMENT MORTAR COATING FROM 30" PIPE TO CLEAR COLLAR.
2. CORE PIPE WALL AND INSTALL COLLAR AND NOZZLE.
3. REPAIR CEMENT MORTAR LINING.
4. REPLACE CEMENT MORTAR COATING.
5. BACKFILL UNDER NOZZLE WITH CLSM.

U CONNECTION DETAIL



V 24" TEE AND BRANCH UP

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REVIEWED: DEPUTY DIRECTOR/ENVIRONMENTAL ENGINEER	DATE



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-	-
CHECKED :	DATE
04/09	04/09
SUBMITTED :	DATE
APRIL 2009	APRIL 2009
SCALE: AS SHOWN	

CAMARILLO SANITARY DISTRICT

VENTURA COUNTY, CALIFORNIA

CAMARILLO TERTIARY EFFLUENT PIPELINE INSTALLATION

DETAILS

JOB NO.

SS-03-03

DRAWING NO.

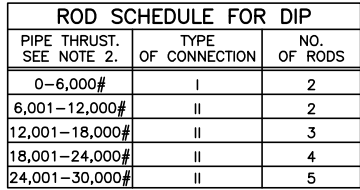
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SHEET NO.

10 OF 11

C-15045

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 DIP FLEXIBLE COUPLING TIE DOWN
 SHEET 1 OF 2
 11-15-05

Technical drawings illustrating two types of pipe connections to a wall, labeled TYPE I CONNECTION and TYPE II CONNECTION, along with a detailed view labeled DETAIL.

TYPE I CONNECTION: Shows a cross-section of a pipe flange (PER PIPE FLANGE) connected to a wall. The connection uses two tie rods (TIE ROD) and two A325 bolts (A325 BOLTS). The distance between the tie rods is 3". The distance from the centerline of the pipe to the centerline of the tie rods is 1 1/8". The tie rods are 1" in diameter. The bolts are 1 1/2" in diameter.

TYPE II CONNECTION: Shows a cross-section of a pipe flange (PER PIPE FLANGE) connected to a wall. The connection uses two tie rods (TIE ROD) and two A325 bolts (A325 BOLTS). The distance between the tie rods is 3". The distance from the centerline of the pipe to the centerline of the tie rods is 1 1/8". The tie rods are 1" in diameter. The bolts are 1 1/2" in diameter.

DETAIL: A close-up view of the tie rod and bolt connection. It shows the tie rod (TIE ROD) passing through the wall and being secured by a nut and washer. The tie rod is 1" in diameter. The bolt is 1 1/2" in diameter. The distance between the tie rods is 1".

NOTES:

1. ALL EXPOSED FLEXIBLE COUPLINGS SHALL HAVE TIE RODS UNLESS SPECIFICALLY INDICATED OTHERWISE ON THE DRAWINGS.
2. PIPE THRUST SHALL BE BASED ON TEST PRESSURE.
3. PIPE THRUST = $0.7854 \times D^2 \times \text{TEST PRESSURE}$, WHERE D IS PIPE OD.
4. MINIMUM TIE ROD YIELD 48,000 PSI.
5. FOR THRUSTS GREATER THAN 30,000 POUNDS, ADD ONE 3/4 INCH DIAMETER ROD FOR EVERY 6,000 POUNDS INCREASE IN THRUST.
6. ALL ROD CONNECTIONS SHALL BE TYPE II FOR THRUSTS GREATER THAN 30,000 POUNDS.
7. GRIND ALL CORNERS SMOOTH.
8. * AS REQD TO CLEAR FLEX CPLG. 3/4" MIN AND 1 1/2" MAX.

P110 TYP	DIP FLEXIBLE COUPLING TIE DOWN	11-15-05
N	SHEET 2 OF 2	

ADJUSTABLE PIPE SADDLE SUPPORT SCHEDULE					
DIMENSIONS IN INCHES					
SIZE OF SUPPORTED PIPE	PIPE SIZE "A"	PIPE SIZE "B"	"C"	"D"	
				MINIMUM	MAXIMUM
2 1/2 *	2 1/2	1 1/2	9	8	13
3	2 1/2	1 1/2	9	8 1/2	13 1/2
3 1/2	2 1/2	1 1/2	9	8 1/2	13 1/2
4	3	2 1/2	9	9 1/2	14
6	3	2 1/2	9	10 1/2	15 1/2
8	3	2 1/2	9	11 1/2	16 1/2
10	3	2 1/2	9	13 1/2	18 1/2
12	3	2 1/2	9	15	19 1/2
14	4	3	11	16 1/2	20 1/2
16	4	3	11	17 1/2	22 1/2
18	6	3 1/2	13 1/2	19 1/2	24
20	6	3 1/2	13 1/2	21	25 1/2
24	6	4	13 1/2	23 1/2	28 1/2
30	6	4	13 1/2	27	31 1/2
32	6	4	13 1/2	28 1/2	32 1/2
36	6	4	13 1/2	30 1/2	34 1/2

P624 TYP ADJUSTABLE PIPE SUPPORT 07-31-08

Technical drawing of a pipeline section, likely for a water supply system. The drawing shows a horizontal pipeline with various components and dimensions.

Components and Dimensions:

- 1 1/2" COMBINATION ARV**: Air Release Valve at the left end.
- 18" 90° BEND**: Bend at the left end.
- 1'**, **3'**, **18" FC**: Dimensions for the first section of the pipe.
- 14" PRESSURE REGULATING VALVE**: Valve in the middle section.
- 2'**, **4'**: Dimensions for the middle section of the pipe.
- 3/4" TAP AND CORP STOP AND PRESSURE GAUGE (TYP OF 2)**: Taps and gauges on the top of the pipe.
- 18" BFV**: Backflow Valve in the middle section.
- 18" 90° BEND**: Bend at the right end.
- 3'**: Dimension for the right end section of the pipe.
- P110 TIE DOWN TYP**: Tie down point.
- P026 18" BUTTERFLY VALVE (TYP OF 2)**: Butterfly valve.
- 18"X14" ECC REDUCER (TYP OF 2)**: Eccentric reducer.
- P624 PIPE SUPPORTS (TYP OF 3)**: Pipe supports.
- 18" 90° BEND**: Bend at the bottom right end.

Legend:

- U T02**: Union.
- HIGH PRESSURE**: Indicated by a shaded circle.
- DIVERSION**: Indicated by a dashed line and a shaded circle.
- EXIST CAMROSA PIPELINES**: Existing pipelines.

SECTION A
EP05
SCALE: NTS
FILE: 6860-C-301

A SECTION
EP05 SCALE: NTS
FILE: 6860-C-301

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RCE 50878 EXP 9-30-11

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WATER RECLAMATION SUPERINTENDENT

REVIEWED:

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CHECKED :	04/09
SUBMITTED : APRIL 2009	
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CAMARILLO SANITARY DISTRICT

VENTURA COUNTY, CALIFORNIA

CAMARILLO TERTIARY EFFLUENT PIPELINE INSTALLATION

DETAILS

JOB NO.
SS-03-03

33-03-03

DRAWING N

T03

SHEET NO.

11 OF 11

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CAMARILLO SANITARY DISTRICT

Camarillo, California

CAMARILLO TERTIARY EFFLUENT PIPELINE INSTALLATION

Client Job No. SS-03-04

**TECHNICAL SPECIFICATIONS
(Divisions 1 through 17)**

FINAL SUBMITTAL

Volume 1 of 1

DECEMBER, 2009



CAMARILLO SANITARY DISTRICT

**Camarillo Wastewater Effluent Pipeline
Job No. S-03-04**

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01292	SCHEDULE OF VALUES
01294	APPLICATIONS FOR PAYMENT
01312	PROJECT MEETINGS
01324C	PROGRESS SCHEDULES AND REPORTS
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	DIVISION 9 - FINISHES
09960B	COATINGS
	DIVISION 10 - SPECIALTIES
	NOT USED
	DIVISION 11 - EQUIPMENT
	NOT USED

SECTION NO.	TITLE
	DIVISION 12 - FURNISHINGS
NOT USED	
	DIVISION 13 - SPECIAL CONSTRUCTION
NOT USED	
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NOT USED	
	DIVISION 15 - MECHANICAL
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	DIVISION 17 - INSTRUMENTATION AND CONTROLS
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SECTION 01110

SUMMARY OF WORK

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes: Identification and summary description of the Project, the Work, location, OWNER furnished products, activities by others, coordination, and early occupancy by OWNER.

1.02 THE WORK

- A. The Work consists of construction of approximately 6,000 linear feet of 24-inch diameter tertiary effluent pipeline, including furnishing all specified materials, trenching, bedding, backfill, removal and replacement of paving, testing, connection to existing facilities, installation of approximately 900 linear feet of pipe by horizontal directional drilling methods, including repair and reconstruction of existing improvements affected by the Work, and incidentals for complete and usable facility.
- B. Except as specifically noted otherwise, provide and pay for:
 - 1. Insurance and bonds.
 - 2. Labor, materials, and equipment.
 - 3. Tools, equipment, and machinery required for construction.
 - 4. Utilities required for construction.
 - 5. Temporary facilities including sheeting and shoring.
 - 6. Traffic control and dust control measures.
 - 7. Other facilities and services necessary for proper execution and completion of the Work.
- C. Secure and pay for all permits including OSHA excavation permits, Department of Transportation permits, government fees and licenses.
- D. Comply with codes, ordinances, regulations, orders, and other legal requirements of public authorities having bearing on the performance of the Work.

1.03 LOCATION OF PROJECT

- A. The Work is located along Howard Road and its prolongations in Camarillo, California.

1.04 OWNER ASSIGNED SUBCONTRACTORS

- A. Assignment of Subcontractors by OWNER is not anticipated.

1.05 OWNER FURNISHED EQUIPMENT

- A. OWNER will furnish the following products:
 - 1. None.

1.06 ACTIVITIES BY OTHERS

- A. OWNER, utilities, and others may perform activities within Project area while the Work is in progress.
 - 1. Schedule the Work with OWNER, utilities, farm owners, and others to minimize mutual interference.
- B. Activities by others which may affect performance of work include:
 - 1. Traffic on roads including Pancho and Howard Roads and unnamed private roadways.
 - 2. Farming operations along the alignment.
 - 3. Operation of OWNER's wastewater treatment plant.
- C. Cooperate with others to minimize interference and delays.
 - 1. When cooperation fails, submit recommendations and perform Work in coordination with work of others as directed.
- D. When the Work depends for proper execution or results upon work performed by others, inspect and promptly report apparent discrepancies or defects in work performed by others.
 - 1. Assume responsibility for work performed by others, except for defects reported as specified in this paragraph and defects which may become apparent in work performed by others after execution of the Work.

1.07 COORDINATION OF WORK

- A. Maintain overall coordination of the Work.
- B. Obtain construction schedules from each subcontractor, and require each subcontractor to maintain schedules and coordinate modifications.

1.08 EARLY OCCUPANCY OF PORTIONS OF WORK

- A. OWNER's partial utilization of portions of Work prior to final acceptance of the completed Work will not be made.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

SECTION 01116

SPECIFICATION LANGUAGE

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes: Explanation of arrangement, language, reference standards, and method of resolving conflicts between Contract Documents.
- B. Related Documents and Sections:
 - 1. General Conditions.
 - 2. Section 01600 - Product Requirements.

1.02 REFERENCES

- A. Construction Specifications Institute (CSI):
 - 1. Manual of Practice - Document MP-2-1, MasterFormat™.
 - 2. Manual of Practice - Document MP-2-2, SectionFormat™.
 - 3. Manual of Practice - Document MP-2-3, PageFormat™.

1.03 SPECIFICATIONS ARRANGEMENT

- A. Document and Section numbers used in Specifications, and Specifications arrangement are in accordance with CSI Document MP-2-1, MasterFormat™, except where departures have been deemed necessary.
- B. Sections are written in CSI SectionFormat™ in accordance with CSI Document MP-2-2, Three-Part Section Format, except where departures have been deemed necessary.
- C. Page format for Sections in the Specifications is in accordance with CSI Document MP-2-3, Page Format, except where departures have been deemed necessary.

1.04 SPECIFICATIONS LANGUAGE

- A. Specification Section Paragraphs entitled "Section Includes" summarizes briefly what is generally included in the section. Requirements of Contract Documents are not limited by "Section Includes" paragraphs. Specifications have been partially streamlined by intentionally omitting words and phrases, such as "the CONTRACTOR shall," "in conformity therewith," "shall be" following "as indicated," "a," "an," "the," and "all". Assume missing portions by inference.
- B. Phrase "by ENGINEER" or "by CM" modifies words such as "accepted," "directed," "selected," "inspected," and "permitted," when they are unmodified.
- C. Phrase "to ENGINEER" or "to CM" modifies words such as "submit," "report," and "satisfactory," when they are unmodified.

- D. Colons (:) are used to introduce a list of particulars, an appositive, an amplification, or an illustrative quotation.
 - 1. When used as an appositive after designation of product, colons are used in place of words "shall be."
- E. Word "provide" means to manufacture, fabricate, deliver, furnish, install, complete, assemble, erect in place, test, render ready for use or operation, including necessary related material, labor, appurtenances, services, and incidentals.
- F. Words "CONTRACTOR shall" are implied when direction is stated in imperative mood.
- G. Term "products" includes materials and equipment as specified in Section 01600.

1.05 REFERENCE STANDARDS

- A. Use edition or amendment of referenced standards in effect on date of bid opening. Use only applicable portions of referenced standards, ignoring payment stipulations and other provisions which change the duties of the ENGINEER, CM, or OWNER as described in the General Conditions.
- B. Equate terms relating to designer to "ENGINEER."
- C. Notify ENGINEER or CM when referenced standard, code, or specification conflicts with Contract Documents.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

SECTION 01140

WORK RESTRICTIONS

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes: Requirements for sequencing and scheduling the Work affected by existing site and facility, work restrictions, and coordination between construction operations and plant operations.
- B. Related Sections:
 - 1. Section 01110 - Summary of Work.
 - 2. Section 01352 - Alteration Project Procedures.
 - 3. Section 01355 - Stormwater Pollution Prevention Construction Activity, and Best Management Practices.
 - 4. Section 01500 - Temporary Facilities and Controls.
 - 5. Section 01734 - Work in Public Right-of-Way.

1.02 GENERAL CONSTRAINTS ON SEQUENCE AND SCHEDULING OF WORK

- A. Work Sequence and Constraints:
 - 1. Utilize description of critical events in work sequence in this Section as a guideline for scheduling and undertaking the Work.
 - 2. Work sequence and constraints presented do not include all items affecting completion of the Work, but are intended to describe critical events necessary to minimize disruption of the existing facilities and activities and to ensure compliance with permit requirements.
 - 3. Construct the portions of the pipeline within and adjacent to Howard Road in one operation and so that the full width of the paved road is available and there is no open trench left on weekends (4:00 p.m. on Fridays to 7:00 a.m. on Mondays) or on holidays or nights (5:00 p.m. to 6:30 a.m.). One lane shall remain open 6:30 a.m. to 5:00 p.m. with Contractor-provided, approved traffic control.
 - 4. Do not construct pipeline within 200 feet of the HDD portion of the project until the HDD work is completed, tested, and accepted.
 - 5. Coordinate work through or along farming areas and operations with the managers of the farming operations.
 - a. Schedule work so as not to interfere with farming operations, planting, harvesting, and irrigation.
 - b. Protect crops and irrigation systems from dust, runoff, and damage by equipment and personnel.
 - c. Reduce length of open trench if necessary to accommodate farming operations, including access to structures, roads, crops, equipment, pipelines, and harvesting.
 - d. Pay for damage to farmers' crops.

1.03 INTERRUPTION OF PROCESSES

- A. Execute the Work while the existing facilities are in operation as specified in Section 01352.
- B. Indicate required shutdowns of existing facilities or interruptions of existing operations on Progress Schedule. Shutdowns will be permitted to the extent that existing operation of the plant and Camrosa Water District (Camrosa) pipelines will not be jeopardized and identified constraints are satisfied.
- C. Submit written notification of required shutdowns of existing facilities at least 7 days prior to the planned date of shutdown.
- D. The CM and the OWNER's personnel will evaluate the request based on the plant's ability to reliably meet capacity and service demands and on Camrosa's pipeline use schedules.
- E. Do not begin alterations until CM's written permission has been received.
- F. Minimize shutdown times by thorough advanced planning. Have required plan, equipment, materials, and labor on hand and ready for review before time of shutdown.
- G. Where required to minimize treatment process or supply interruptions while complying with specified sequencing constraints, provide temporary pumping, power, lighting, controls, instrumentation, and safety devices.

1.04 OPERATIONS AND MAINTENANCE ACCESS

- A. Provide safe, continuous access to process equipment for plant operations personnel, to farmers' fields, equipment, systems, and crops, and to traffic on public and private roads. At least one traffic lane shall be open at all times on all roads.
- B. At least one paved land on Howard Road shall remain open at all times.
- C. When only one land on Howard Road is in service, grade and maintain an off-road land so that two-way traffic is accommodated, or provide flag control personnel. Two lane paved road will be open during night hours and week ends.

1.05 SHUTDOWN CONSTRAINTS

- A. Comply with shutdown constraints imposed by Camrosa for connection to Camrosa's facilities, and Camarillo Sanitary District for connection at plant.

1.06 UTILITIES

- A. Provide advance notice to and utilize services of Underground Services Alert (U.S.A.) for location and marking of underground utilities operated by utility agencies other than the OWNER.
- B. Maintain electrical, telephone, water, gas, sanitary facilities, and other utilities in service. Provide temporary utilities when necessary.

1.07 COORDINATION OF WORK

- A. Maintain overall coordination of the Work.
- B. Obtain construction schedules from subcontractors and suppliers and assume responsibility for correctness.
- C. Incorporate schedules from subcontractors, suppliers, and farmers into Progress Schedule to plan for and comply with sequencing constraints.

1.08 WORK BY OTHERS

- A. Where proper execution of the Work depends upon work by others, inspect and promptly report discrepancies and defects.

1.09 TEMPORARY SERVICES, MATERIALS, AND EQUIPMENT

- A. Locate temporary facilities in a manner that minimizes interference to OWNER's operation and maintenance personnel and operations of others, including farmers and traffic along Pancho and Howard Roads.
- B. Unless otherwise specified, install temporary pipelines of the same size as its connection to the existing facility at the downstream end of the pipeline.
- C. Provide piping of suitable material for the material being conveyed.
- D. Dewater and promptly clean basins and channels temporarily removed from service.
- E. Dimensions for all existing structures, piping, paving, and other nonstructural items are approximate. The CONTRACTOR shall field verify all dimensions and conditions and report any discrepancies to the CM a minimum of 14 days in advance of any construction in the area.
- F. Discrepancies between coordinates, bearings and lengths, and stationing shall be resolved in the following order of precedence:
 - 1. Coordinates.
 - 2. Bearings and lengths.
 - 3. Stationing.

1.10 CONNECTIONS TO CAMROSA WATER DISTRICT'S FACILITIES

- A. Make connections to Camrosa's pipelines as shown, specified, and as coordinated with Camrosa.
- B. Make connections only after the new pipeline has been successfully tested and approved by the CM.
- C. Notify and coordinate with Camrosa at least 7 days before connections are proposed to be made. Coordinate Work at Camrosa's facilities with Bob Wilber at (805) 482-9643 or Bill Keyes at (805) 482-9629.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

SECTION 01201
PAYMENT PROCEDURES

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes: Procedures for submitting applications for payment and means used as a basis for Progress Payments, including:
 - 1. Cost Summaries.
 - 2. Payment for Mobilization.
 - 3. Start-Up.
 - 4. Demobilization.
- B. Related Sections:
 - 1. Section 01292 - Schedule of Values.

1.02 BASIS FOR PROGRESS PAYMENTS

- A. Base Application for Payment on the breakdown of costs for each scheduled activity in the Progress Schedule and the Percentage of Completion for each activity. Generate Application for Payment by downloading cost data from the Progress Schedule to a spreadsheet type format. Identify each activity on the Progress Schedule that has a cost associated with it, the cost of each activity, the estimated Percent Complete for each activity, the units complete, and the Value of Work Completed for both the previous and present payment period and job to date.

1.03 PAYMENT REQUESTS

- A. Prepare progress payment requests on a monthly basis. Base requests on the breakdowns of costs for each scheduled activity and the percentage of completion for each activity, or the units complete.
- B. Indicate total dollar amount of work planned for every month of the project. Equate sum of monthly amounts to Lump Sum Contract Price.
- C. Generate Progress Payment request forms by downloading cost data from the schedule information to a spreadsheet type format. Identify each activity on the Progress Schedule that has a cost associated with it, the cost for each activity, the estimated percent complete for each activity, the units complete, and the value of work completed for both the previous and present payment period and job to date.
- D. Prepare summary of cost information for each Major Item of Work listed in the Schedule of Values. Identify the value of work completed for both the payment period and job to date.
- E. Submit progress payment requests at progress meetings.

1.04 COST SUMMARIES

- A. Prepare Summary of Cost Information for each Major Item of Work listed in the Schedule of Values. Identify the Value of Work Completed for both the previous and present payment period and job to date.
- B. Cash Flow Summary: Prepare cash flow summary, indicating total dollar amount of work planned for each month of the project. Equate sum of monthly amounts to Lump Sum contract price.

1.05 PAYMENT FOR MOBILIZATION

- A. Limit amounts included under Mobilization to the following items:
 - 1. Moving on the site any equipment required for first month's operations.
 - 2. Installing temporary construction power and wiring.
 - 3. Establishing fire protection system.
 - 4. Developing construction water supply.
 - 5. Providing field office trailers for the CONTRACTOR and the ENGINEER, complete with all specified furnishings and utility services including telephones if required.
 - 6. Providing on-site sanitary facilities and potable water facilities as specified.
 - 7. Arranging for and erection of CONTRACTOR's work and storage yard.
 - 8. Subcontractor insurance and bonds.
 - 9. Obtaining all required permits, licenses, and fees.
 - 10. Developing construction schedule.
 - 11. Provide and erect the project sign if required.
 - 12. CONTRACTOR bonds and insurance.
- B. Furnish data and documentation to substantiate the amounts claimed under mobilization.
- C. Limit price for mobilization to no more than 5 percent of Contract Price.

1.06 PAYMENT FOR START-UP AND DEMOBILIZATION

- A. Total Price for start-up and demobilization shall not be less than 3 percent of Contract Price.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

SECTION 01292

SCHEDULE OF VALUES

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes: Requirements for preparation, format, and submittal of Schedule of Values.

1.02 PREPARATION

- A. Prepare Schedule of Values identifying costs of Major Items of Work and other costs shown in sample included at end of this Section.
- A. Divide the Work into following Major Items of Work and subdivide the Major Items for the various DIVISIONs 2 to 16 of work.
 - 1. Mobilization.
 - 2. Safety Plan.
 - 3. Compliance with Excavation Safety Regulations.
 - a. Traffic control.
 - b. Dust control.
 - c. Street cleaning.
 - d. Construction manager's field office, including utilities.
 - e. Disposal of excess excavated material.
 - f. Disposal of construction debris.
 - g. Protection of crops and farming operations.
 - 4. Project Schedule.
 - 5. Site Work.
 - 6. Stormwater Prevention Plan and Permit.
 - 7. Effluent Pipe from Treatment Plant to Howard Road.
 - 8. Camarillo/Camrosa Connections.
 - 9. Effluent Pipe Howard Road to Calleguas Creek.
 - 10. Calleguas Creek crossing.
 - 11. Connection to Camrosa Intermediate Pressure Pipeline.
 - 12. Testing.
 - 13. Start-Up and Demobilization.
- B. Assign prices to Major Items of Work which aggregate the Contract Price. Base prices on costs associated with scheduled activities based on the Project Schedule for each Major Item of Work.
- C. Show unit prices where applicable or requested by OWNER, CM, or ENGINEER.

1.03 SUBMITTALS

- A. Submit preliminary schedule of values within 7 days of award of contract.

- B. Submit corrected schedule of values within 10 days upon receipt of reviewed Schedule of Values, but no later than 10 days prior to anticipated submittal of first Application for Payment.
- C. Upon request, support prices with data which will substantiate their correctness.
- D. If activities are added or removed from the Progress Schedule revise the Schedule of Values and resubmit.

1.04 SAMPLE SCHEDULE OF VALUES

- A. Following is an acceptable basis for Schedule of Values. Expand per Section 1.02.

SCHEDULE OF VALUES		
No.	Description Of Item	Lump Sum Cost
1.	Mobilization. Not to exceed 5 percent of contract price.	
2.	General earthwork and grading.	
3.	Pipeline: List Major Items of Work identified in Article 1.02, Paragraph C and number consecutively.	
4.	Horizontal Directional Drilling.	
5.	Major Items of Work (for example, connections, testing, etc.)	
6.	Traffic Control.	
7.	Start-up and demobilization. Not to be less than 3 percent of contract price.	
8.	Miscellaneous work items and other prices not included in previous items and necessary to complete the Work.	
Total Lump Sum Bid		

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

SECTION 01294
APPLICATIONS FOR PAYMENT

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes: Procedures for preparation and submittal of Applications for Payment.
- B. Related Sections:
 - 1. Section 01292 - Schedule of Values.
 - 2. Section 01324C - Progress Schedules and Reports.

1.02 FORMAT

- A. Develop satisfactory spreadsheet-type form generated by downloading cost data from the Progress Schedule.
- B. Fill in information required on form.
- C. When Change Orders are executed, add Change Orders at end of listing of scheduled activities.
 - 1. Identify change order by number and description.
 - 2. Provide cost of change order in appropriate column.
- D. After completing, submit Application for Payment.
- E. The Construction Manager (CM) will review application for accuracy. When accurate, CM will transmit application to OWNER for processing of payment.
- F. Execute application with signature of responsible officer of CONTRACTOR.

1.03 SUBSTANTIATING DATA

- A. Provide Substantiating Data with cover letter identifying:
 - 1. Project.
 - 2. Application number and date.
 - 3. Detailed list of enclosures.
 - 4. For stored products with item number and identification on application, description of specific material, and proof of insurance coverage for offsite stored products.
 - 5. Submit "certified" payroll.

1.04 SUBMITTALS

- A. Submit two copies of Application for Payment and Substantiating Data with cover letter.

1.05 PAYMENT REQUESTS

- A. Prepare progress payment requests on a monthly basis. Base requests on the breakdowns of costs for each scheduled activity and the percentage of completion for each activity.
- B. Indicate total dollar amount of work planned for every month of the project. Equate sum of monthly amounts to Lump Sum Contract Price.
- C. Generate Progress Payment request forms by downloading cost data from the schedule of value information to a spreadsheet type format.
- D. Prepare summary of cost information for each Major Item of Work listed in the Schedule of Values. Identify the value of work completed for both the payment period and job to date.
- E. Submit progress payment requests at progress meetings.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

SECTION 01312

PROJECT MEETINGS

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes: Requirements for conducting conferences and meetings for the purposes of addressing issues related to the Work, reviewing and coordinating progress of the Work and other matters of common interest, and includes the following:
 - 1. Qualifications of Meeting Participants.
 - 2. Preconstruction Conference Progress Meetings.
 - 3. Pre-Installation Meetings.
 - 4. Post Construction Meeting.

1.02 QUALIFICATIONS OF MEETING PARTICIPANTS

- A. Representatives of entities participating in meetings shall be qualified and authorized to act on behalf of entity each represents.

1.03 PRECONSTRUCTION CONFERENCE

- A. Upon issuance of Notice to Proceed, or earlier when mutually agreeable, OWNER will arrange preconstruction conference in convenient place for most persons invited.
- B. Attending Preconstruction Conference: CONTRACTOR's superintendent, OWNER, CM, ENGINEER, representatives of utilities, major subcontractors, farm managers, and others involved in performance of the Work, and others necessary to agenda.
- C. CM will preside at conference.
- D. Purpose of Conference: To establish working understanding between parties and to discuss Construction Schedule, Shop Drawing and other submittals, cost breakdown of major lump sum items, processing of submittals and applications for payment, and other subjects pertinent to execution of the Work.
- E. Agenda Will Include:
 - 1. Adequacy of distribution of Contract Documents.
 - 2. Distribution and discussion of list of major subcontractors and suppliers.
 - 3. Proposed progress schedules and critical construction sequencing.
 - 4. Major equipment deliveries and priorities.
 - 5. Project coordination.
 - 6. Designation of responsible personnel.
 - 7. Procedures and Processing of:
 - a. Field decisions.
 - b. Proposal requests.
 - c. Submittals.

- d. Change Orders.
 - e. Applications for Payment.
 - f. Record Documents.
 - 8. Use of Premises:
 - a. Office, construction, and storage areas.
 - b. OWNER's requirements.
 - 9. Construction facilities, controls, and construction aids.
 - 10. Shoring requirements and submittal of CONTRACTOR'S geotechnical report.
 - 11. Temporary utilities.
 - 12. Safety and first aid procedures.
 - 13. Security procedures.
 - 14. Housekeeping procedures.
- F. The CM will record minutes of meeting and distribute copies of minutes within 7 days of meeting to participants and interested parties.

1.04 PROGRESS MEETINGS

- A. Conduct progress meetings at least once every 2 weeks unless, based on construction activities, OWNER decides more or less frequent meetings are beneficial. Meetings will be held in CONTRACTOR's field office or other mutually agreed upon place.
- B. Distribute to each anticipated participant written notice and agenda of each meeting at least 4 days before meeting.
- C. Require attendance of CONTRACTOR's superintendent and subcontractors who are or are proximate to be actively involved in the Work, or who are necessary to agenda.
- D. Invite OWNER, ENGINEER, CM, utility companies, farm managers and others when the Work affects their interests, and others necessary to agenda.
- E. Complete and bring Application for Payment and Progress and Look-A-Head Schedule to progress meeting.
- F. Prepare and distribute agenda.
- G. Preside at meetings.
- H. Purpose of Progress Meetings: To expedite work of CONTRACTOR, subcontractors or other organizations that are not meeting scheduled progress, resolve conflicts, and coordinate and expedite execution of the Work.
- I. Review progress of the Work, Progress Schedule, narrative report, Application for Payment, record documents, and additional items of current interest that are pertinent to execution of the Work.
- J. Verify:
 - 1. Actual start and finish dates of completed activities since last progress meeting.
 - 2. Durations and progress of activities not completed.

3. Reason, time, and cost data for Change Order Work that will be incorporated into Progress Schedule and application for payment.
 4. Percentage completion of items on Application for Payment.
 5. Reasons for required revisions to Progress Schedule and their effect on Contract Time and Contract Price.
- K. Discuss potential problems which may impede scheduled progress and corrective measures.
- L. The CONTRACTOR will record minutes of meeting and distribute copies of minutes within 4 days of meeting to participants and interested parties.

1.05 PRE-INSTALLATION MEETINGS

- A. General: Meet with manufacturers and installers of major units of construction which require coordination between subcontractors. Major units of construction which require pre-installation meetings include:
1. All inter-tie connections.
 2. Stream crossing.
 3. Work near farming operations.
- B. Distribute to each anticipated participant written notice and agenda of each meeting at least 4 days before meeting.
- C. Schedule meeting at least 7 days in advance of installation.
- D. Conduct meetings in CONTRACTOR's field office or other mutually agreed upon place.
- E. Require attendance of Superintendent, appropriate manufacturers and installers of major units of constructions, and affected subcontractors.
- F. Invite OWNER, CM, ENGINEER, and others appropriate to the Work.
- G. Preside at meetings.
- H. Record minutes of meeting and distribute copies of minutes within 3 days of meeting to participants and interested parties.

1.06 POST CONSTRUCTION MEETING

- A. Meet with and inspect the Work 11 months after date of Substantial Completion with OWNER, CM, and ENGINEER.
- B. Arrange meeting at least 7 days before meeting.
- C. Meet in OWNER's office or other mutually agreed upon place.
- D. Inspect the Work and draft list of items to be completed or corrected.
- E. Review service and maintenance contracts, and take appropriate corrective action when necessary.

- F. Complete or correct defective work and extend correction period accordingly.
- G. Require attendance of Superintendent, appropriate manufacturers and installers of major units of constructions, and affected subcontractors.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

SECTION 01324C

PROGRESS SCHEDULES AND REPORTS

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes: Preparation, submittal, and maintenance of computerized progress schedule and reports, contract time adjustments, and payment requests, including the following:
 - 1. Preliminary Schedule.
 - 2. Baseline Schedule.
 - 3. Weekly Schedule.
 - 4. Schedule Updates.
 - 5. Schedule Revisions.
 - 6. Time Impact Analyses.
- B. Related Sections:
 - 1. Section 01292 - Schedule of Values.
 - 2. Section 01294 - Applications for Payment.
 - 3. Section 01312 - Project Meetings.
 - 4. Section 01770 - Closeout Procedures.

1.02 RESPONSIBLE PERSON

- A. Designate, in writing and within 5 calendar days after Notice of Award, person responsible for preparation, maintenance, updating, and revision of all schedules.
- B. Qualifications of Responsible Person:
 - 1. Authority to act on behalf of CONTRACTOR.
 - 2. 5 years verifiable experience in preparation of complex construction schedules for projects of similar value, size and complexity.
 - 3. Knowledge of critical path method (CPM) scheduling utilizing Primavera Project Planner or SureTrak.
 - 4. Provide proposed Scheduler's resume with three (3) references, and the review is subject to CM's acceptance and approval.

1.03 SCHEDULING FORMAT AND SOFTWARE

- A. Schedule Format: Utilize CPM format.
- B. Prepare computerized schedule utilizing Primavera Project Planner or SureTrak, most current version(s). The CONTRACTOR will provide one licensed copy of the scheduling software to the CONSTRUCTION MANAGER, registered in the CM's name, for the duration of the project.

1.04 PRECONSTRUCTION SCHEDULING MEETING

- A. CM will conduct Preconstruction Scheduling Meeting with CONTRACTOR's Project Manager, General Superintendent, and scheduler within 7 calendar days after Notice-To-Proceed. This meeting is separate from the Preconstruction Conference Meeting and is intended to cover schedule issues exclusively.
- B. At the meeting, scheduling requirements shall be reviewed with CONTRACTOR. These include schedule preparation, reporting requirements, updates, revisions, and schedule delay analysis. CONTRACTOR shall present their schedule methodology, planned sequence of operations, and present their proposed activity coding structure.

1.05 PREPARATION

- A. Preparation and submittal of Progress Schedule represents CONTRACTOR's intention to execute the Work within specified time and constraints. Failure to conform to requirement may result in termination for cause under General Condition Article 15.02, Suspension of Work and Termination.
- B. CONTRACTOR's bid covers all costs associated with the execution of the Work in accordance with the Progress Schedule.
- C. During preparation of the preliminary Progress Schedule, CM will facilitate CONTRACTOR's efforts by being available to answer questions regarding sequencing issues, scheduling constraints, interface points, and dependency relationships. Prepare schedule utilizing Precedence Diagramming Method (PDM).
- D. Prepare schedule utilizing activity durations in terms of working days. Do not exceed 10 working days duration on activities except concrete curing, submittal review, and equipment fabrication and deliveries. Where duration of continuous work exceeds 10 working days, subdivide activities by location, stationing, or other sub-element of the Work. CONTRACTOR shall coordinate holidays to be observed with the OWNER and incorporate them into the schedule as non-working days.
- E. Failure to include an activity required for execution of the Work does not excuse CONTRACTOR from completing the Work and portions thereof within specified times and at price specified in Agreement. Failure of CONTRACTOR to include required schedule constraints, sequences, or milestones in schedule shall not relieve CONTRACTOR of obligation to conform to requirements of Contract. Acceptance of schedule shall not waive Contract requirements. In event of conflict between accepted schedule and Contract requirements, terms of Contract shall govern at all times, unless requirements are waived in writing by the OWNER.
- F. Reference schedule to working days with beginning of Contract Time as Day "1."
- G. Should CONTRACTOR submit a Baseline Schedule showing project completion more than 20 working days prior to Contract completion date, OWNER may issue Change Order, at no cost to OWNER, revising time of performance of Work and Contract completion date to match CONTRACTOR's schedule completion date. Contract milestone dates, if any, shall be adjusted accordingly.

- H. Contract float is for the mutual benefit of both OWNER and CONTRACTOR. Changes to the project that can be accomplished within this available period of float may be made by OWNER without extending the Contract time, by utilizing float. No time extensions shall be granted nor delay damages owed until Work extends beyond currently accepted Contract completion date. Likewise, CONTRACTOR may utilize float to offset delays other than delays caused by OWNER. Mutual use of float shall continue until all available float shown by schedule has been utilized by either OWNER or CONTRACTOR, or both. At that time, extensions of the Contract time will be granted by OWNER for valid OWNER-caused or third party-caused delays which affect the planned completion date and which have been properly documented and demonstrated by CONTRACTOR.
- I. Non-sequestering of float: Pursuant to float sharing requirements of Contract, use of float suppression techniques such as preferential sequencing or logic, special lead or lag logic restraints, extended activity durations, or imposed dates shall be cause for rejection of any schedule submittal.
- J. Interim milestone dates, operational constraints. In event there are interim milestone dates and/or operational constraints set forth in Contract, CONTRACTOR shall show them on schedule as specified in Contract. CONTRACTOR shall not use Zero Total Float constraint or Mandatory Finish Date on such Contract requirements.
- K. Schedule windows for OWNER-furnished, CONTRACTOR-installed equipment or materials: Immediately after Award of Contract CONTRACTOR shall obtain from OWNER anticipated delivery dates of OWNER-furnished equipment or materials. These dates shall be shown on schedule in same manner indicated by OWNER.

1.06 SUBMITTAL OF PROGRESS SCHEDULES

- A. Submit preliminary and baseline schedule in accordance with the Conditions of the Contract as modified by this Section.
- B. Submit, on a monthly basis, updated schedules as specified. Submit final schedule update as specified.
- C. Submit revised schedules and time impact analyses as specified.
- D. Submit schedules in the media and number of copies as follows.
 - 1. Three sets of the CPM network and/or bar chart (as specified by the OWNER) on D-size plots in PDF format on the CD. Color-coding to be specified by the OWNER.
 - 2. Three sets of Tabular reports listing all activities sorted numerically identifying duration, early start, late start, early finish, late finish, total float, and all predecessor/successor information.
 - 3. Two sets of compact disks or DVDs containing the computerized CPM Schedule data file(s).

1.07 PRELIMINARY SCHEDULE

- A. CONTRACTOR shall submit Preliminary Schedule within 10 calendar days after Notice-To-Proceed. Preliminary Schedule shall contain detailed plan of operations for first 90 calendar days of Work after receipt of Notice to Proceed.

- B. ENGINEER and CONTRACTOR shall meet within 7 calendar days after receipt of Preliminary Schedule to review and make necessary adjustments. CONTRACTOR shall submit revised preliminary schedule within 5 calendar days after meeting.
- C. Accepted Preliminary Schedule shall be incorporated unchanged, as first 90 calendar days of activity in CONTRACTOR's Baseline Schedule.
- D. Preliminary Schedule shall be updated monthly during first 90 calendar days after Notice to Proceed.

1.08 BASELINE SCHEDULE

- A. No more than 30 calendar days after Notice of Award, CONTRACTOR shall submit the Baseline Schedule for all Work of the project. Baseline Schedule shall show sequence and interdependence of all activities required for complete performance of all Work, beginning with date of Notice to Proceed and concluding with date of final completion of Contract.
- B. Baseline Schedule shall conform to requirements of the following Article, "Network Details and Graphical Output."

1.09 NETWORK DETAILS AND GRAPHICAL OUTPUT

- A. Produce a clear, legible, and accurate calendar-based, time-scaled, graphical network diagram. Group activities related to the same physical areas of the Work. Produce the network diagram based upon the early start of all activities.
- B. Include for each activity, the description, activity number, estimated duration in working days, total float and all activity relationship lines.
- C. Illustrate order and interdependence of activities and sequence in which Work is planned to be accomplished. Incorporate the basic concept of the precedence diagram network method to show how the start of one activity is dependent upon the start or completion of preceding activities and its completion restricts the start of following activities.
- D. Indicate the critical path for the project.
- E. Delineate the specified contract duration and identify the planned completion of the Work as a milestone. The time period between the-planned and Contract completion dates, if any, shall be shown on the schedule as an activity identified as project float unless a Change Order is issued pursuant to Article 1.05, Paragraph H.
- F. Identify system shutdown dates, system tie-in dates, specified interim completion or milestone dates, and contract completion date as milestones.
- G. Include in addition to Construction Activities:
 - 1. Submission dates and review periods for major equipment submittals, shoring submittals, and indicator pile program.
 - a. Shoring Reviews: Allow 4-week review period for each shoring submittal.
 - b. Allow minimum 3-week review period for all other submittals.
 - 2. Any activity by the OWNER, the CM, or the ENGINEER that may affect progress or required completion dates.

3. Equipment and long-lead material deliveries over 6 weeks.
 4. Approvals required by regulatory agencies or other third parties. Produce network diagram on PDF format on CD with grid coordinate system on the border of all sheets utilizing alpha and numeric designations.
- H. Identify the Execution of the following, omitting items not applicable to the Work:
1. Mobilization.
 2. All required submittals and submittal review times showing 30-calendar-day duration for such activities and equal amount of time for re-submittal reviews.
 3. Equipment and materials procurement/fabrication/delivery.
 4. Excavation.
 5. Shoring design and submission of detailed shoring submittals. Identify submission as a milestone.
 6. Shoring review, shoring materials procurement, shoring installation, and shoring removal.
 7. Horizontal Directional Drilling:
 - a. Setup and planning.
 - b. Materials.
 - c. Drilling.
 - d. Back reaming.
 - e. Pipe Installation.
 - f. Completion.
 8. Backfill and compaction.
 9. Dewatering.
 10. Grading, subbase, base, paving, and curb and gutters.
 11. Concrete, including installation of forms and reinforcement, placement of concrete, curing, stripping, finishing, and patching.
 12. Metal fastenings, framing, structures, and fabrication.
 13. Finishes including coating and painting.
 14. Trenching, pipe laying, and trench backfill and compaction.
 15. Piping, fittings, and appurtenances, including identification of order lead time, Installation, and testing.
 16. Valves, gates and operators, including identification of order lead time, installation, and testing.
 17. Plumbing specialties.
 18. Preliminary testing of equipment, instrumentation, and controls.
 19. Final Testing, including preparation time.
 20. 7-day operational test.
 21. Punch list work.
 22. Operation and maintenance training.
 23. Demobilization.

1.10 SCHEDULE OF SHOP DRAWING AND SAMPLE SUBMITTALS

- A. After Preliminary Schedule has been submitted and accepted by OWNER, CONTRACTOR shall submit a list of all Shop Drawings and sample submittals anticipated in first 90 calendar days after Notice-to-Proceed using early start dates.

- B. After Baseline Schedule has been submitted and accepted by OWNER, CONTRACTOR shall print out and submit list of all shop drawings and sample submittals for all Work using early start dates. This listing will contain all submittals required for the entire Work including those listed above. These schedules shall conform to the requirements of General Condition Article 2.05.

1.11 WEATHER DAYS ALLOWANCE

- A. Include as a separate identifiable activity on the critical path, an activity labeled "Weather Days Allowance." Insert this activity at the end of the schedule.
- B. Duration of Weather Days Allowance is specified in Conditions of the Contract.
- C. Insert an activity in critical path to reflect weather day occurrences when weather days are experienced and accepted by ENGINEER. Identify this activity as a weather delay.
- D. Reduce duration of Weather Days Allowance activity as weather delays are experienced and inserted into the schedule. Remaining weather days in Weather Day Allowance at completion of project is considered float.

1.12 REVIEW AND ACCEPTANCE OF SCHEDULES

- A. ENGINEER will review Baseline Schedules, Schedule Updates, Schedule Revisions, and Time Impact Analyses to ascertain compliance with specified project constraints, compliance with milestone dates, reasonableness of durations and sequence, accurate inter-relationships, and completeness.
- B. ENGINEER and OWNER will issue written comments following completion of review of Baseline Schedule within 21 calendar days after receipt. Written comments on review of Schedule Updates and Schedule Revisions and Time Impact Analyses will be returned to CONTRACTOR within 14 calendar days after receipt by ENGINEER.
- C. Revise and resubmit schedule in accordance with ENGINEER's comments within 7 calendar days after receipt of such comments, or request joint meeting to resolve objections. If a meeting is requested the CONTRACTOR and all major subcontractors shall participate in the meeting with ENGINEER. Revise and resubmit schedule within 7 calendar days after meeting.
- D. When schedule reflects OWNER's and CONTRACTOR's agreement of project approach and sequence, schedule will be accepted by OWNER. Use accepted schedule for planning, organizing and directing the work and for reporting progress. Provide all items specified in Article, "Submittal of Project Schedules."

1.13 UPDATING THE SCHEDULE

- A. Update the schedule on a monthly basis, using a data date as specified by the ENGINEER.
- B. Should monthly Schedule Update show project completion earlier than current Contract completion date, CONTRACTOR shall show early completion time as schedule activity, identified as "Project Float."

- C. Should monthly Schedule Update show project completion later than current Contract completion date, CONTRACTOR shall prepare and submit a Schedule Revision in accordance with Article, 1.14, Revisions to Schedule.

1.14 REVISIONS TO SCHEDULE

- A. Submit revised schedule within 5 calendar days:
 - 1. When delay in completion of any activity or group of activities indicates an overrun of the Contract time or milestone dates by 20 working days or 5 percent of the remaining duration, whichever is less.
 - 2. When delays in submittals, deliveries, or work stoppages are encountered making necessary the replanning or rescheduling of activities.
 - 3. When the schedule does not represent the actual progress of activities.
 - 4. When any change to the sequence of activities, the completion date for major portions of the work, or when changes occur which affect the critical path.
 - 5. When Contract modification necessitates schedule revision, submit schedule analysis of change order work with cost proposal.
- B. Submit revised schedule and materials as specified under Article, "Submittal of Progress Schedule."
- C. Make revisions on most recently accepted version of schedule.
- D. Schedule Revisions shall not be prepared or submitted with Schedule Updates. They shall be separate submittals and shall be noted as Schedule Revisions.
- E. Only upon acceptance of a revision by the OWNER shall it be reflected in the next monthly Schedule Update.
- F. Schedule Revisions submitted for the purpose of mitigating a CONTRACTOR-caused project delay (Recovery Schedule) shall not be implemented until the OWNER reviews and accepts the Schedule Revision.

1.15 WEEKLY SCHEDULE

- A. Submit to ENGINEER, on the last working day of every week, a progress schedule showing the activities completed during the previous week and the CONTRACTOR's schedule of activities for the following 2 weeks.
- B. The Weekly Schedule may be a CPM schedule or a bar chart but shall utilize the logic and conform to the status of the current progress schedule. In the event that the Weekly Schedule no longer conforms to the current schedule CONTRACTOR may be required to revise the schedule in accordance with Article "Revisions to Schedule."
- C. The activity designations used in the Weekly Schedule shall be consistent with those used in the Baseline Schedule and the monthly Schedule Updates.
- D. The format of the Weekly Schedule shall be as agreed upon between the CONTRACTOR and the ENGINEER.

1.16 ADJUSTMENT OF CONTRACT TIMES

- A. If the CONTRACTOR believes that the OWNER has impacted its work, such that the project completion date will be delayed, the CONTRACTOR must submit proof demonstrating the delay to the critical path. This proof, in the form of a Time Impact Analysis, may entitle the CONTRACTOR to an adjustment of contract time.
- B. Time Impact Analysis:
 - 1. The time impact analysis submitted by the CONTRACTOR shall utilize the accepted schedule update that is current relative to the time frame of the delay event (change order, third party delay, or other OWNER-caused delay). The CONTRACTOR shall represent the delay event in the schedule by:
 - a. Inserting new activities associated with the delay event into the schedule.
 - b. Revising activity logic.
 - c. Revising activity durations.
 - 2. If the project schedule's critical path and completion date are impacted as a result of adding this delay event to the schedule, a time extension equal to the magnitude of the impact may be warranted.
 - 3. The Time Impact Analysis submittal shall consist of:
 - a. A fragment of the portion of the schedule affected by the delay event.
 - b. A narrative explanation of the delay issue and how it impacted the schedule.
 - c. A diskette containing the schedule file used to perform the Time Impact Analysis.
- C. When a delay to the project as a whole can be avoided by revising preferential sequencing or logic, and the CONTRACTOR chooses not to implement the revisions, the CONTRACTOR will be entitled to a time extension and no compensation for extended overhead.
- D. Indicate clearly that the CONTRACTOR has used, in full, all project float available for the work involved in the request, including any float that may exist between the CONTRACTOR's planned completion date and the Contract completion date. Utilize the latest version of the Schedule Update accepted at the time of the alleged delay, and all other relevant information, to determine the adjustment of the contract time.
- E. Float shall be for the mutual benefit of the OWNER and the CONTRACTOR. Adjustment of the Contract Times will be granted only when the Contract Float has been fully utilized and only when the revised date of completion of the Work has been pushed beyond the contract completion date. Adjustment of the Contract Times will be made only for the number of days that the planned completion of the work has been extended.
- F. Actual delays in activities which do not affect the critical path work or which do not move the CONTRACTOR's planned completion date beyond the Contract completion date will not be the basis for an adjustment to the contract time.
- G. The CONTRACTOR shall not be entitled to job-site or home office overhead beyond the CONTRACTOR's originally planned occupancy of the site if completion of the project occurs within the specified contract time.

- H. Notify ENGINEER of a request for contract time adjustment. Submit request in accordance with Article 10 - Changes in the Work: Claims, of the General Conditions. In cases where the CONTRACTOR does not submit a request for contract time adjustment for a specific change order, delay, or CONTRACTOR request within the specified period of time, then it is mutually agreed that the particular change order, delay, or CONTRACTOR request has no time impact on the Contract completion date and no time extension is required.
- I. The ENGINEER will, within 30 calendar days after receipt of a contract time adjustment, request any supporting evidence, review the facts and advise the CONTRACTOR in writing. The new Progress Schedule data, if accepted by the OWNER, shall be included in the next monthly Schedule Update.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

SECTION 01329

SAFETY PLAN

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes: Development and maintenance of a Construction Safety Plan.

1.02 REFERENCES

- A. California Labor Code, Section 6401.7.
- B. OSHA.

1.03 CONSTRUCTION SAFETY PLAN

- A. Detail the Methods and Procedures to comply with California Labor Code Section 6401.7, Federal, and Local Health and Safety Laws, Rules and Requirements for the duration of the Contract Times. Include the following:
 - 1. Identification of the Certified or Licensed Safety Consultant who will prepare, initiate, maintain, and supervise safety programs and procedures.
 - 2. Procedures for providing workers with an awareness of safety and health hazards expected to be encountered in the course of construction.
 - 3. Safety equipment appropriate to the safety and health hazards expected to be encountered during construction. Include warning devices, barricades, safety equipment in public right-of-way and protected areas, and safety equipment used in multi-level structures.
 - 4. Methods for minimizing employees' exposure to safety and health hazards expected during construction.
 - 5. Procedures for reporting safety or health hazards.
 - 6. Procedures to follow to correct a recognized safety and health hazard.
 - 7. Procedures for investigation of accidents, injuries, illnesses and unusual events that have occurred at the construction site.
 - 8. Periodic and scheduled inspections of general work areas and specific work stations.
 - 9. Training for employees and workers at the jobsite.
 - 10. Methods of communication of safe working conditions, work practices, and required personal protection equipment.
- B. Assume responsibility for every aspect of Health and Safety on the jobsite, including the health and safety of Subcontractors, suppliers, and other persons on the jobsite.
 - 1. Forward available information and reports to the Safety Consultant who shall make the necessary recommendations concerning worker health and safety at the jobsite.
 - 2. Employ additional health and safety measures specified by the Safety Consultant, as necessary, for workers in accordance with OSHA guidelines.
- C. Transmit to OWNER and CM copies of reports and other documents related to accidents or injuries encountered during construction.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

SECTION 01330

SUBMITTAL PROCEDURES

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes: Requirements and procedures for submitting Shop Drawings, Product Data, samples, other submittals relating to products, and as specified in individual sections.

1.02 DEFINITIONS

- A. Manufacturer's Instructions: Instructions, stipulations, directions, and recommendations issued in printed form by the manufacturer of a product addressing handling, installation, erection, and application of the product. Manufacturer's instructions are not prepared especially for the Work.
- B. Shop Drawings: Drawings, diagrams, schedules, and other data specially prepared for the Work to illustrate some portion of the Work.
- C. Product Data: Illustrations, standard schedules, performance charts, brochures, diagrams, and other information to illustrate materials or equipment for some portion of the Work.
- D. Samples: Physical examples which illustrate materials, equipment, or workmanship and establish standards by which the Work will be judged.
- E. Special Samples: Physical examples which illustrate materials, equipment, or workmanship and establish standards by which the Work will be judged, and will be incorporated in the Work.

1.03 PROCEDURES

- A. Deliver submittals to CM at address listed on the cover of the Contract Documents, unless another mutually agreeable place is designated.
- B. Submit submittals in ample time for each to serve submittals' intended purpose.
- C. Submit submittals which are specified or reasonably required for construction, operation, and maintenance of the Work.
- D. Deliver submittals under acceptable transmittal form which identifies:
 - 1. Submittal date.
 - 2. Project and CONTRACTOR.
 - 3. Subcontractor and major supplier, when appropriate.
 - 4. Reference submittal to Contract Documents by Drawing, detail, and/or Specification section numbers, as appropriate.
 - 5. Variations from Contract Documents when variations are included in submittal.

- E. Submit specified number of copies of submittal.
- F. Provide or furnish products and execute the Work in accordance with accepted submittals, unless in conflict with Contract Documents.
- G. When minor deviations from Contract Documents are accepted, modify Contract Documents in accordance with the Conditions of the Contract.

1.04 SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES

- A. Submit Shop Drawings, Product Data, samples, and other pertinent information in sufficient detail to show compliance with specified requirements.
- B. Check, verify, and revise submittals as necessary to bring them into conformance with Contract Documents and actual field conditions.
 - 1. Determine and verify quantities, dimensions, specified design and performance criteria, materials, catalog numbers, and similar data.
 - 2. Coordinate submittal with other submittals and with the requirements of the Contract Documents.
- C. After completion of checking, verification, and revising; stamp, sign and date submittals indicating review and approval; and submit to CM.
 - 1. Stamp and signature indicates CONTRACTOR has satisfied Shop Drawing review responsibilities and constitutes CONTRACTOR's written approval of Shop Drawing.
 - 2. Shop Drawings without CONTRACTOR's written approval will be returned for resubmission.
- D. Shop Drawings: Submit five copies. One will be returned with reviewer's comments and stamp. Submit additional copies if more than one returned is required.
- E. Product Data and Manufacturer's Instructions: Submit four copies. Excise or cross out non-applicable information and clearly mark applicable information with citations to and terminology consistent with Contract Documents.
 - 1. One copy will be returned with reviewer's comments and stamp.
- F. Samples: Submit two samples labeled with reference to applicable Contract Documents. Label will be returned with reviewer's selection when appropriate, comments and stamp. Samples will not be returned unless return is requested in writing and additional sample is submitted.
- G. Special Samples: Submit one sample labeled with reference to applicable Contract Documents. Sample and one label will be returned for installation in the Work.
- H. Assume risk of expense and delays when proceeding with work related to required submittals without review and acceptance.

1.05 MANUFACTURER'S INSTRUCTIONS

- A. Submit manufacturer's instructions whenever made available by manufacturers and when installation, erection, or application in accordance with manufacturer's instructions are required by the Specifications.

- B. Submit manufacturer's instructions prior to installation, erection, or application of equipment and other project components. Submit manufacturer's instructions in accordance with requirements for Product Data.

1.06 ENGINEER'S REVIEW

- A. ENGINEER's review of submittals shall not release CONTRACTOR from CONTRACTOR's responsibility for performance of requirements of Contract Documents. Neither shall ENGINEER's review release CONTRACTOR from fulfilling purpose of installation nor from CONTRACTOR's liability to replace defective work.
- B. Do not consider submittals as Contract Documents. Purpose of submittals is to demonstrate how CONTRACTOR intends to conform with the design concepts.
- C. ENGINEER's review of Shop Drawings, samples, or test procedures will be only for conformance with design concepts and for compliance with information given in Contract Documents.
 - 1. ENGINEER's review does not extend to:
 - a. Accuracy of dimensions, quantities, or performance of equipment and systems designed by CONTRACTOR.
 - b. CONTRACTOR's means, methods, techniques, sequences, or procedures except when specified, indicated on the Drawings, or required by Contract Documents.
 - c. Safety precautions or programs related to safety which shall remain the sole responsibility of the CONTRACTOR.
- D. Except as may be provided in subsequent specifications, a submittal will be returned within 30 days. When a submittal cannot be returned within that period, ENGINEER will, within a reasonable time after receipt of the submittal, give notice of the date by which that submittal will be returned.
- E. For submittals returned Resubmittal Not Required - Make Corrections Noted/See All Comments, CONTRACTOR shall incorporate all review comments into the work, but resubmittal of an amended submittal package is not required.
- F. For submittals returned Correct and Resubmit – Make Corrections Noted/See All Comments, CONTRACTOR shall incorporate the review comments into a complete revised package, and resubmit it for review.
- G. For submittals returned Rejected - See All Comments, CONTRACTOR shall develop a new submittal package with materials, equipment, methods, etc. that meet the requirements of the Contract Documents.
- H. For submittals returned Submittal Not Reviewed, Filed for Record, no further action is required by the CONTRACTOR for this submittal.
- I. ENGINEER will be entitled to rely upon the accuracy or completeness of designs, calculations, or certifications made by licensed professionals accompanying a particular submittal whether or not a stamp or seal is required by Contract Documents or Laws and Regulations.

- J. Costs incurred by OWNER as a result of additional reviews of a particular submittal after the second time it has been reviewed shall be borne by CONTRACTOR. Reimbursement to OWNER will be made by deducting such costs from CONTRACTOR's subsequent partial payments.

1.07 MINOR OR INCIDENTAL PRODUCTS AND EQUIPMENT SCHEDULES

- A. Shop Drawings of minor or incidental fabricated products will not be required, unless requested.
- B. Submit tabulated lists of minor or incidental products showing the names of the manufacturers and catalog numbers, with Product Data and samples as required to determine acceptability.

1.08 SUBMITTALS FOR INFORMATION OR RECORD ONLY

- A. Submit three copies of each. None will be returned.
- B. Mill Test Reports:
 - 1. Submit four certified copies of factory and mill test reports for record only. No copies will be returned.
 - 2. Do not incorporate Products in the Work which have not passed testing and inspection satisfactorily.
 - 3. Pay for mill and factory tests.
- C. Reinforcing Steel:
 - 1. Submit reinforcing steel fabrication and setting drawings for information or record only. No copies will be returned.
 - 2. Note deviations and variations as specified for Shop Drawings.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

SECTION 01350

SPECIAL PROCEDURES

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes: Special procedures for locating and verifying concealed existing facilities.

1.02 CONCEALED EXISTING FACILITIES

- A. Verify locations of utilities and facilities which may exist by consulting with the OWNER, utility companies, city and county jurisdictions, farmers, and other landowners and managers, and Underground Services Alert (USA) or other service available in area of Project.
 - 1. Abide by easement and right-of-way restrictions.
 - 2. Uncover all piping and conduits to a point 1 foot below the pipe where crossings, interferences, or connections are shown on the Drawings, prior to trenching or excavating for any pipe or structures, to determine actual elevations. Refer also to Article 1.03, Pipeline Potholing, below.
- B. Notify OWNER, owners of facilities, and appropriate others when the Work will be in progress. Make arrangements for potential emergency repairs in accordance with requirements of owners of utility facilities, including individual or residential facilities.
- C. Assume responsibility for repair of facilities damaged by performance of the Work.
- D. Expose sanitary and storm sewers, water, gas, electric, telephone utility lines, and other underground facilities indicated to permit survey location prior to commencement of Work in affected area.
 - 1. Expose in ample time to permit relocation of interfering utilities with minimum delaying effect on contract time.
- E. Work required for raising, lowering, or relocating utilities not indicated will be performed by affected utility owners or as part of the Work at option of affected owners of utilities.
 - 1. When part of the Work, perform work in accordance with standards of affected utility owner, and adjustment to Contract Price and Contract Times will be made as stipulated in conditions of contract.

1.03 PIPELINE POTHOLING

- A. To determine locations and depths of existing underground utilities, CONTRACTOR shall conduct exploratory excavations by potholing. Potholing shall be performed as soon as practical following award of the Contract, and in any event, a sufficient time in advance of any excavation or construction in that area to avoid possible delay in the progress of work. Schedule potholing work with the CM and the respective utility owners at least 10 working days in advance of performing potholing. The CONTRACTOR shall perform the potholing only in the presence of the CM.

- B. Apply for, obtain, and comply with all permits required for potholing.
- C. If any existing pipeline or utility was not identified in the Contract Documents but was subsequently discovered and recorded by potholing, pipeline or utility shall be considered as an existing known condition. Under these circumstances, the CONTRACTOR shall be responsible for protecting the pipeline or utility. The additional work incurred due to protecting the pipeline or utility, subject to concurrence of the CM, will be paid for as extra work in accordance with the General Conditions. Excavation and backfill for potholing shall conform to the requirements of this Section.
- D. Determine the true location and depth of existing utilities and service connections which may be affected by, or will affect, the pipeline construction. Determine the type, outside diameters, material, and conditions of these utilities. Pothole all utilities, except those listed in the Contract Documents as already being potholed, not less than 30 calendar days prior to submitting pipe laying Drawings, and provide the results to the CM.
- E. The CM and ENGINEER will review the potholing information, and if a change in pipeline profile is necessary to avoid a potential utility conflict, a design change will be issued to the CONTRACTOR not less than 15 days prior to the submission of pipe laying Drawings.
- F. Expose existing utilities at least 14 days in advance of the pipeline construction.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

SECTION 01350

SPECIAL PROCEDURES

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes: Special procedures for locating and verifying concealed existing facilities.

1.02 CONCEALED EXISTING FACILITIES

- A. Verify locations of utilities and facilities which may exist by consulting with the OWNER, utility companies, city and county jurisdictions, farmers, and other landowners and managers, and Underground Services Alert (USA) or other service available in area of Project.
 - 1. Abide by easement and right-of-way restrictions.
 - 2. Uncover all piping and conduits to a point 1 foot below the pipe where crossings, interferences, or connections are shown on the Drawings, prior to trenching or excavating for any pipe or structures, to determine actual elevations. Refer also to Article 1.03, Pipeline Potholing, below.
- B. Notify OWNER, owners of facilities, and appropriate others when the Work will be in progress. Make arrangements for potential emergency repairs in accordance with requirements of owners of utility facilities, including individual or residential facilities.
- C. Assume responsibility for repair of facilities damaged by performance of the Work.
- D. Expose sanitary and storm sewers, water, gas, electric, telephone utility lines, and other underground facilities indicated to permit survey location prior to commencement of Work in affected area.
 - 1. Expose in ample time to permit relocation of interfering utilities with minimum delaying effect on contract time.
- E. Work required for raising, lowering, or relocating utilities not indicated will be performed by affected utility owners or as part of the Work at option of affected owners of utilities.
 - 1. When part of the Work, perform work in accordance with standards of affected utility owner, and adjustment to Contract Price and Contract Times will be made as stipulated in conditions of contract.

1.03 PIPELINE POTHOLING

- A. To determine locations and depths of existing underground utilities, CONTRACTOR shall conduct exploratory excavations by potholing. Potholing shall be performed as soon as practical following award of the Contract, and in any event, a sufficient time in advance of any excavation or construction in that area to avoid possible delay in the progress of work. Schedule potholing work with the CM and the respective utility owners at least 10 working days in advance of performing potholing. The CONTRACTOR shall perform the potholing only in the presence of the CM.

- B. Apply for, obtain, and comply with all permits required for potholing.
- C. If any existing pipeline or utility was not identified in the Contract Documents but was subsequently discovered and recorded by potholing, pipeline or utility shall be considered as an existing known condition. Under these circumstances, the CONTRACTOR shall be responsible for protecting the pipeline or utility. The additional work incurred due to protecting the pipeline or utility, subject to concurrence of the CM, will be paid for as extra work in accordance with the General Conditions. Excavation and backfill for potholing shall conform to the requirements of this Section.
- D. Determine the true location and depth of existing utilities and service connections which may be affected by, or will affect, the pipeline construction. Determine the type, outside diameters, material, and conditions of these utilities. Pothole all utilities, except those listed in the Contract Documents as already being potholed, not less than 30 calendar days prior to submitting pipe laying Drawings, and provide the results to the CM.
- E. The CM and ENGINEER will review the potholing information, and if a change in pipeline profile is necessary to avoid a potential utility conflict, a design change will be issued to the CONTRACTOR not less than 15 days prior to the submission of pipe laying Drawings.
- F. Expose existing utilities at least 14 days in advance of the pipeline construction.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

SECTION 01352

ALTERATION PROJECT PROCEDURES

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes: Requirements and procedures for performing alterations to existing facilities.
- B. Related Sections:
 - 1. Section 01500 - Temporary Facilities and Controls.
 - 2. Section 01770 - Closeout Procedures.

1.02 SUBMITTALS

- A. Alterations Schedule: Submit in accordance with requirements for Progress Schedules.

1.03 SEQUENCE AND SCHEDULES

- A. Perform Work in sequences and within times specified in Section 01140.
- B. Submit separate detailed sub-schedule for alterations, coordinated with construction schedules. Indicate:
 - 1. Each stage of Work and dates of occupancy of areas.
 - 2. Date of Substantial Completion for each area of alterations as appropriate.
 - 3. Trades and subcontractors employed in each stage.

1.04 WORK INVOLVED WITH EXISTING OPERATING FACILITIES

- A. Perform the Work while existing facility is in operation.
- B. Do not jeopardize operation or materially reduce efficiency of existing facility.
- C. Coordinate the Work with operation of the facility.
 - 1. Do not begin alterations of designated portions of the Work until specific permission has been granted in writing by OWNER in each case.
 - 2. CM will coordinate the planned procedure with facility manager.
 - 3. Complete as quickly as possible and with as little delay as possible, connections to existing equipment and utilities, and other operations that interfere with the operation of existing facility.
- D. Operational functions of the facility that are required to be performed to facilitate the Work will be performed by facility personnel only.

- E. Plant Supervisor will cooperate in every way practicable to assist in expediting the Work.
- F. When necessary for the proper operation or maintenance of portions of the facility, reschedule Work operations so that the Work will not conflict with necessary operations or maintenance of the facility.

1.05 PREPARATION

- A. Identify existing materials which shall be patched, extended, or matched.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

SECTION 01354

HAZARDOUS MATERIAL PROCEDURES

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes: Procedures required when encountering hazardous materials at the Work site.

1.02 REFERENCES

- A. California Health and Safety Code, Section 25117.
- B. State of California Code of Regulations (CCR).
 - 1. Title 8. Industrial Relations.
 - a. Division 1. Department of Industrial Relations.
 - 2. Title 22. Social Security:
 - a. Division 4. Environmental Health.
 - b. Division 4.5. Environmental Health Standards for the Management of Hazardous Waste.
- C. United States Code of Federal Regulation (CFR), Title 29 and Title 40.
 - 1. 29 CFR 1910.1000.
 - 2. 29 CFR 1910.134.

1.03 SUBMITTALS

- A. Submit laboratory reports, hazardous material removal plans, and certifications.

1.04 HAZARDOUS MATERIALS PROCEDURES

- A. Hazardous materials are those defined by California Health and Safety Code, Section 25117.
- B. When Hazardous Materials Have Been Found:
 - 1. Prepare and initiate implementation of plan of action.
 - 2. Notify immediately OWNER, CM, and other affected persons.
 - 3. Notify such agencies as are required to be notified by Laws and Regulations with the times stipulated by such Laws and Regulations.
 - 4. Designate a Certified Industrial Hygienist to issue pertinent instructions and recommendations for protection of workers and other affected persons' health and safety.
 - 5. Identify and contact subcontractors and licensed personnel qualified to undertake storage, removal, transportation, disposal, and other remedial work required by, and in accordance with laws and regulations.
- C. Forward to CM, copies of reports, permits, receipts, and other documentation related to remedial work.

- D. Assume responsibility for worker health and safety, including health and safety of subcontractors and their workers.
 - 1. Instruct workers on recognition and reporting of materials that may be hazardous.
- E. File requests for adjustments to Contract Times and Contract Price due to the finding of Hazardous Materials on the Work site.
 - 1. Minimize delays by continuing performance of the Work in areas not affected by hazardous materials operations.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

SECTION 01355

STORMWATER POLLUTION PREVENTION CONSTRUCTION ACTIVITY - BEST MANAGEMENT PRACTICES

PART 1 GENERAL

1.01 DESCRIPTION

- A. The CONTRACTOR shall apply and pay for and receive a State of California General Construction Activity Stormwater Permit. The permit authorizes the discharge of stormwater associated with construction activity from construction sites. The CONTRACTOR shall comply with the following prohibitions and limitations, which are contained in the stormwater permit:
 - 1. Discharge prohibitions:
 - a. Discharges of materials other than stormwater, which are not otherwise regulated by a NPDES permit, to a separate stormwater sewer system or water of the nation are prohibited.
 - b. Stormwater discharges shall not cause or threaten to cause pollution, contamination (including sediment), or nuisance.
 - c. Stormwater discharges regulated by this general permit shall not contain a hazardous substance equal to or in excess of a reportable quantity listed in 40 CFR Part 117 and/or 40 CFR Part 302.
 - 2. Receiving Water Limitations:
 - a. Stormwater discharges to any surface or groundwater shall not adversely impact human health or the environment.
 - b. Stormwater discharge shall not cause or contribute to a violation of any applicable water quality standards contained in the California Ocean Plan, Inland Surface Waters and Enclosed Bays and Estuaries Plan, or the applicable Regional Water Board's Basin Plan.

1.02 COMPLIANCE

- A. The CONTRACTOR shall comply with the State Water Resources Control Board, Regional Water Quality Control Board, County, City, Municipality, and other local agency requirements regarding stormwater discharges and management.

1.03 SUBMITTALS

- A. The CONTRACTOR shall prepare and submit the required Notice of Intent and obtain a Stormwater Pollution Prevention Plan in accordance with Section A of the General Construction Activity Stormwater Permit 15 days after Notice to Proceed. The CONTRACTOR shall also prepare and submit a monitoring program and reporting plan in accordance with Section B of the General Construction Activity Stormwater Permit. Refer to the SWRCB website (<http://www.swrcb.ca.gov/stormwtr/construction.html>) to obtain the SWPPP BMP and application information.

- B. The CONTRACTOR is required to submit per Section 01330 for approval a Stormwater Pollution Prevention Plan detailing the placement of physical Best Management Practices (BMPs) required for installation and the methods used to comply with those BMPs directed at operational procedures, and Monitoring Program and Reporting Plan.
- C. The plan must specifically address and detail changes from the alternatives called out in this section. The CONTRACTOR's preferred techniques will have to show how it will comply with the stated objectives of the program.
- D. The CONTRACTOR shall submit a copy of the BMP Handbook with each BMP to be utilized check marked to show compliance or marked to show deviation.
- E. The plan must be accepted by the Engineer prior to any on site work. Acceptance of the plan does not preclude the CONTRACTOR from responsibility for taking the proper actions to prevent contaminants and/or sediments from entering the storm sewer drainage system should any unforeseen circumstance occur. The CONTRACTOR shall take immediate action if directed by the ENGINEER, or if the CONTRACTOR observes contaminants and/or sediments entering the storm drainage system, to prevent further stormwater from entering the system.
- F. The CONTRACTOR shall be responsible for filing (a Notice of Intent) and securing a permit with the SWRCB. Filing costs are calculated by the following formula: (\$200 + \$20/acre) 18.5 percent surcharge. CONTRACTOR shall pay all subsequent annual permit costs required for the permit by the SWRCB.

1.04 PERMIT FEE

- A. The General Construction Activity Stormwater Permit is an annual permit. The Contractor shall submit the yearly fee to the State for the duration of the project.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

3.01 STORMWATER POLLUTION PREVENTION PLAN IMPLEMENTATION

- A. The CONTRACTOR shall implement all activities required by the General Permit and as detailed in the Stormwater Pollution Prevention Plan, Monitoring Program, and Reporting Plan.
- B. The CONTRACTOR shall immediately report to OWNER and CM all notices to comply or any other communication from officials monitoring or enforcing the Stormwater Pollution Prevention Plan.
- C. A copy of the Stormwater Pollution Prevention Plan and all reports and communications related to such plan shall be kept and available for inspection at the worksite.

3.02 NON-STORMWATER MANAGEMENT

- A. The Stormwater Pollution Prevention Plan shall discuss: any non-stormwater sources (i.e., landscaping irrigation, pipe flushing, street washing, and dewatering). In addition, the Plan shall include standard observation measures and best management practices, including best available technologies economically achievable and best conventional pollutant control technologies that are to be implemented in order to reduce the pollutant loading to the waters.

3.03 AMENDMENTS

- A. The CONTRACTOR shall amend the Stormwater Pollution Prevention Plan, Monitoring Program, and Reporting Plan whenever there is a change in construction or operations which may affect the discharge of pollutants to stormwater. The Stormwater Pollution Prevention Plan shall also be amended if it is in violation of any conditions of the general permit or has not achieved the general objective of reducing pollutants in storm water discharges.

3.04 YEARLY SUMMARY

- A. The CONTRACTOR shall submit to the Regional Water Quality Control Board a summary report including, but not limited to: Construction activities; project status and documentation of non-stormwater discharge. The report shall be in accordance with all Regional Water Quality Control Board requirements.

3.05 NOTICE OF TERMINATION

- A. The CONTRACTOR shall submit to the State Water Resources Control Board, a Notice of Termination upon completion of all construction activities, in accordance with Section C of the General Construction Activity Stormwater Permit.

END OF SECTION

SECTION 01424

ABBREVIATIONS

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes: Abbreviations and meanings.

1.02 INTERPRETATIONS

- A. Interpret abbreviations by context in which abbreviations are used.

1.03 ABBREVIATIONS

- A. Abbreviations used to identify Reference Standards:

AA	Aluminum Association
AAMA	Architectural Aluminum Manufacturers Association
AAN	American Association of Nurserymen
AASHTO	American Association of State Highway and Transportation Officials
ABC	Associated Air Balance Council
ACI	American Concrete Institute
ACIL	American Council of Independent Laboratories
ADC	Air Diffusion Council
ABMA	American Bearing Manufacturers' Association (formerly AFBMA, Anti-Friction Bearing Manufacturers' Association)
AGA	American Gas Association
AGC	Associated General Contractors
AGMA	American Gear Manufacturers' Association
AI	Asphalt Institute
AIA	American Institute of Architects
AIMA	Acoustical and Insulating Materials Association
AISC	American Institute of Steel Construction
AISI	American Iron and Steel Institute
AITC	American Institute of Timber Construction
AMCA	Air Moving and Conditioning Association
ANSI	American National Standards Institute
APA	American Plywood Association
API	American Petroleum Institute
ARI	Air Conditioning and Refrigeration Institute
ASAHC	American Society of Architectural Hardware Consultants
ASHRAE	American Society of Heating, Refrigeration and Air Conditioning Engineers
ASME	American Society of Mechanical Engineers
ASTM	ASTM International (Former name American Society for Testing and Materials. Still used in specifications.)
AWPA	American Wood Preservers Association

AWPI	American Wood Preservers Institute
AWS	American Welding Society
AWSC	American Welding Society Code
AWWA	American Water Works Association
CLFMI	Chain Link Fence Manufacturers Institute
CPSC	U.S. Consumer Product Safety Commission
CRA	California Redwood Association
CRSI	Concrete Reinforcing Steel Institute
CS	Commercial Standards
CSI	Construction Specifications Institute
EIFS	Exterior Insulation and Finish System
EJCDC	Engineers Joint Contract Documents Committee
FIA	Factory Insurance Association
FM	Factory Mutual
FS	Federal Specifications
IAPMO	International Association of Plumbing and Mechanical Officials
ICBO	International Conference of Building Officials
IEEE	Institute of Electrical and Electronics Engineers
MS	Military Specifications
NAAMM	National Association of Architectural Metal Manufacturers
NAPA	National Asphalt Pavement Association
NBHA	National Builders Hardware Association
NCMA	National Concrete Masonry Association
NEC	National Electrical Code
NECA	National Electrical Contractors Association
NETA	International Electrical Testing Association
NEMA	National Electrical Manufacturers Association
NFPA	National Fire Protection Association
NFPA	National Forest Products Association
NIST	National Institute of Standards and Technology
NMWIA	National Mineral Wood Insulation Association
NPCA	National Paint and Coatings Association
PCA	Portland Cement Association
PCI	Prestressed Concrete Institute
PDCA	Paint and Decorating Contractors of America
PDI	Plumbing and Drainage Institute
PS	Product Standard
RWQCB	Regional Water Quality Control Board
SAE	Society of Automotive Engineers
SCPA	Structural Clay Products Association
SMACNA	Sheet Metal and Air Conditioning Contractors National Association
SSPC	Society for Protective Coatings-Steel Structures Painting Council

UBC	Uniform Building Code (ICBO)
UL	Underwriters Laboratories, Inc.
UNS	Unified Numbering System
USDA	United States Department of Agriculture
WCLA	West Coast Lumberman's Association
WCLIB	West Coast Lumber Inspection Bureau
WPA	Western Pine Association
WPOA	Western Plumbing Officials Association
WRC	Welding Research Council
WSCPA	Western States Clay Products Association
WWPA	Western Wood Products Association

B. Abbreviations used in Specifications:

a	year or years (metric unit)
A	ampere or amperes
am	ante meridian (before noon)
ac	alternating current
ac-ft	acre-foot or acre-feet
atm	atmosphere
AWG	American Wire Gauge
bbl	barrel or barrels
bd	board
bhp	brake horsepower
bil gal	billion gallons
BOD	biochemical oxygen demand
Btu	British thermal unit or units
Btuh	British thermal units per hour
bu	bushel or bushels
C	degrees Celsius
cal	calorie or calories
Camrosa	Camrosa Water District
cap	capita
cd	candela or candelas
cfm	cubic feet per minute
Ci	curie or curies
CM	Construction Manager
cm	centimeter or centimeters
cmu	concrete masonry unit
CO	carbon monoxide
Co.	Company
CO ₂	carbon dioxide
COD	chemical oxygen demand
Corp.	Corporation
counts/min	counts per minute
cu	cubic
cu cm	cubic centimeter or centimeters
cu ft	cubic foot or feet

cu ft/day	cubic feet per day
cu ft/hr	cubic feet per hour
cu ft/min	cubic feet per minute
cu ft/sec	cubic feet per second
cu in	cubic inch or inches
cu m	cubic meter or meters
cu yd	cubic yard or yards
d	day (metric units)
day	day (English units)
db	decibels
DB	dry bulb (temperature)
dc	direct current
diam	diameter
DO	dissolved oxygen
DS	dissolved solids
emf	electromotive force
fpm	feet per minute
F	degrees Fahrenheit
ft	feet or foot
fc	foot-candle or foot candles
ft/day	feet per day
ft/hr	feet per hour
ft/min	feet per minute
ft/sec	feet per second
g	gram or grams
G	gravitational force
gal	gallon or gallons
gal/day	gallons per day
gal/min	gallons per minutes
gal/sec	gallons per second
gfd	gallons per square foot per day
g/L	grams per liter
gpd	gallons per day
gpd/ac	gallons per day per acre
gpd/cap	gallons per day per capita
gpd/sq ft	gallons per day per square foot
gph	gallons per hour
gpm	gallons per minute
gps	gallons per second
h	hour or hours (metric units)
ha	hectare or hectares
HDD	Horizontal directional drilling
hp	high point
hp	horsepower
hp-hr	horsepower-hour or horsepower-hours
hr	hour or hours (English units)
Hz	hertz

ID	inside diameter
ihp	indicated horsepower
Inc.	Incorporated
inch	inch
inches	inches
inches/sec	inches per second
J	joule or joules
JTU	Jackson turbidity unit or units
k	kips
K	kelvin
K	thermal conductivity
kcal	kilocalorie or kilocalories
kcmil	thousand circular mils
kg	kilogram or kilograms
km	kilometer or kilometers
kN	kilonewton or kilonewtons
kPa	kilopascal or kilopascals
ksi	kips per square inch
kV	kilovolt or kilovolts
kVA	kilovolt-ampere or kilovolt-amperes
kW	kilowatt or kilowatts
kWh	kilowatt hour
L	liter or liters
lb/1,000 cu ft	pounds per thousand cubic foot
lb/acre-ft	pounds per acre-foot
lb/ac	pounds per acre
lb/cu ft	pounds per cubic foot
lb/day/cu ft	pounds per day per cubic foot
lb/day/acre	pounds per day per acre
lb/sq ft	pounds per square foot
lin	linear, lineal
lin ft	linear foot or feet
lm	lumen or lumens
log	logarithm (common)
ln	logarithm (natural)
lx	lux
m	meter or meters
M	molar (concentration)
mA	milliampere or milliamperes
max	maximum
mCi	millicurie or millicuries
meq	milliequivalent
μF	microfarad or microfarads
MFBM	thousand feet board measure
mfr	manufacturer
mg	milligram or milligrams
mgd/ac	million gallons per day per acre

mgd	million gallons per day
mg/L	milligrams per liter
µg/L	micrograms per liter
µm	micrometer or micrometers
mile	mile
mil. gal	million gallons
miles	miles
min	minimum
min	minute or minutes
MLSS	mixed liquor suspended solids
MLVSS	mixed liquor volatile suspended solids
mm	millimeter or millimeters
mol wt	molecular weight
mol	mole
Mpa	megapascal or megapascals
mph	miles per hour
MPN	most probable number
mR	milliroentgen or milliroentgens
Mrad	megarad or megarads
mV	millivolt or millivolts
MW	megawatt or megawatts
N	newton or newtons
N	normal (concentration)
No.	number
NOI	Notice of Intent
Nos	numbers
NRC	noise reduction coefficient
NTU or ntu	nephelometric turbidity unit
oc	on center
OD	outside diameter
ORP	oxidation-reduction potential
OT	ortho-tolidine
OTA	ortha-tolidine-arsenite
oz	ounce or ounces
oz/sq ft	ounces per square foot
Pa	pascal or pascals
pl	plate or property line
pm	post meridiem (afternoon)
ppb	parts per billion
ppm	parts per million
ppt	parts per thousand
pr	pair
psf/hr	pounds per square foot per hour
psf	pounds per square foot
psi	pounds per square inch
psia	pounds per square inch absolute
psig	pounds per square inch gauge
PVC	polyvinyl chloride
qt	quart or quarts

R	radius
R	roentgen or roentgens
rad	radiation absorbed dose
RH	relative humidity
rpm	revolutions per minute
rps	revolutions per second
s	second (metric units)
S	Siemens (mho)
SDI	sludge density index or silt density index
sec	second (English units)
SI	International System of Units
sp	static pressure
sp gr	specific gravity
sp ht	specific heat
sq	square
cm ² or sq cm	square centimeter or centimeters
sq ft	square feet or foot
sq inch	square inch
sq inches	square inches
km ² or sq km	square kilometer or kilometers
m ² or sq m	square meter or meters
mm ² or sq mm	square millimeter or millimeters
sq yd	square yard or yards
SS	suspended solids
STC	Sound Transmission Class
SVI	sludge volume index
SWPPP	Stormwater Pollution Prevention Plan
TDS	total dissolved solids
TKN	total Kjeldahl nitrogen
TLM	median tolerance limit
TOC	total organic carbon
TOD	total oxygen demand
TOW	top of weir
TS	total solids
TSS	total suspended solids
TVS	total volatile solids
U	U Factor/U Value
U	Coefficient of Heat Transfer
U	heat transfer coefficient
UNS	Uniform Numbering System
US	United States
V	volt or volts
VA	volt-ampere or volt-amperes
W	watt or watts
WB	wet bulb
wg	water gauge

wk	week or weeks
wt	weight
yd	yard or yards
yr	year or years (English unit)

C. Abbreviations used on Drawings: As listed on Drawings or in Specifications.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

SECTION 01450
QUALITY CONTROL

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes: Quality control requirements and procedures for products and workmanship and includes the following:
 - 1. Sampling and testing of materials.
 - 2. Testing of equipment.
 - 3. Requirements for testing laboratories.
 - 4. Procedures and limitations of inspection.

1.02 REFERENCES

- A. American Society for Testing and Materials (ASTM):
 - 1. E 329 - Standard for Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction.

1.03 PRODUCTS AND WORKMANSHIP

- A. When specified, products will be tested and inspected either at point of origin or at worksite.
 - 1. Notify Construction Manager (CM) in writing well in advance of when products will be ready for testing and inspection at point of origin.
 - 2. Do not construe that satisfactory tests and inspections at point of origin is final acceptance of products. Satisfactory tests or inspections at point of origin do not preclude retesting or re-inspection at worksite.
- B. Do not ship products which require testing and inspection at point of origin prior to testing and inspection.

1.04 AUTHORITY AND DUTIES OF OWNER'S REPRESENTATIVE OR INSPECTOR

- A. OWNER's Representative or Inspector employed or retained by OWNER, CM, or ENGINEER is authorized to inspect the Work.
- B. Inspections may extend to entire or part of the Work and to preparation, fabrication, and manufacture of products for the Work.
- C. Deficiencies or defects in the Work which have been observed will be called to CONTRACTOR's attention.
- D. Inspector Will Not:
 - 1. Alter or waive provisions of Contract Documents.
 - 2. Inspect CONTRACTOR's means, methods, techniques, sequences, or procedures for construction.

3. Accept portions of the Work, issue instructions contrary to intent of Contract Documents, or act as foreman for CONTRACTOR. Supervise, control, or direct CONTRACTOR's safety precautions or programs; or inspect for safety conditions on worksite, or of persons thereon, whether CONTRACTOR's employees or others.
- E. Inspector Will:
1. Conduct on-site observations of the Work in progress to assist CM in determining when the Work is, in general, proceeding in accordance with Contract Documents.
 2. Report to CM whenever Inspector believes that Work is faulty, defective, does not conform to Contract Documents, or has been damaged; or whenever there is defective material or equipment; or whenever Inspector believes the Work should be uncovered for observation or requires special testing.

1.05 INSPECTION

- A. Material and equipment, and workmanship shall be subject to inspection and rejection when not in conformance with Contract Documents.
- B. Remove defective work and products from Work site, whether in place or not, and replace or renew with work, material, or equipment in conformance with Contract Documents.
- C. Questions concerning acceptability of materials, classification of materials, and execution of the Work will be decided by ENGINEER.
- D. Facilitate inspection by maintaining proper facilities and providing safe access to the Work, to shops where products are in preparation, and to warehouses and storage yards where products are stored.
- E. CM's observation of Work that will be covered:
1. When directed to allow observation of work before it is covered, provide timely notification of work readiness and allow CM reasonable time to observe such work before covering it.
 2. Uncover, at CONTRACTOR'S cost, work covered for which CM was not given timely notification or reasonable time to conduct observations.
 3. ENGINEER may specify time requirements for timely notification and for performing observations.

1.06 SAMPLING AND TESTING

- A. General:
1. Prior to delivery and incorporation in the Work, submit listing of sources of materials, when specified in Sections where materials are specified.
 2. When specified in Sections where products are specified,
 - a. Submit sufficient quantities of representative samples of character and quality required of materials to be used in the Work for testing or examination.
 - b. Test materials in accordance with standards of national technical organizations.

- B. Sampling:
 - 1. Furnish specimens of materials when requested.
 - 2. Do not use materials which are required to be tested until testing indicates satisfactory compliance with specified requirements.
 - 3. Specimens of materials will be taken for testing whenever necessary to determine quality of material.
 - 4. Assist CM in preparation of test specimens at site of Work, such as soil samples and concrete test cylinders.
- C. Testing:
 - 1. OWNER will employ and pay for services of independent testing laboratory to perform routine tests of materials to confirm compliance with requirements of Contract Documents.
 - a. Mill tests, tests of imported materials, tests of other materials to be used in the Work, and other specified tests shall be paid for by CONTRACTOR.
 - 2. When protesting failed tests of material in place or to be used request additional tests.
 - a. When original test proves to have been in error, OWNER will pay for the testing, but not for the CONTRACTOR's expenses for assistance in sampling, rework, or other effort.
 - b. When retesting shows similar results to the original failed tests, CONTRACTOR shall reimburse OWNER for the cost of sampling and testing.
- D. Test Standards:
 - 1. Perform sampling, specimen preparation, and testing of materials in accordance with specified standards, and when no standard is specified, in accordance with standard of nationally recognized technical organization.
 - 2. Physical characteristics of materials not particularly specified shall conform to standards published by ASTM, where applicable.
 - 3. Standards and publication references in Contract Documents shall be edition or revision in effect on date bids are submitted.

1.07 TESTING LABORATORY SERVICES

- A. Qualification of Laboratory:
 - 1. Meets "Recommended Requirements for Independent Laboratory Qualification," published by American Council of Independent Laboratories.
 - 2. Meets requirements of ASTM E 329.
 - 3. Has authorization to operate in state in which Project is located.
 - 4. Will submit copy of report of inspection of facilities made by Materials Reference Laboratory of NBS during most recent tour of inspection, with memorandum of remedies of deficiencies reported by inspection.
 - 5. Has testing equipment calibrated at reasonable intervals by devices of accuracy traceable to NBS or accepted values of natural physical constants.
- B. Laboratory Duties:
 - 1. Cooperate with CM and CONTRACTOR.
 - 2. Provide qualified personnel.
 - 3. Notify CM and CONTRACTOR, in writing, of response time needed to schedule testing or inspections after receipt of notice.

4. Perform specified inspections, sampling, and testing of materials and methods of construction in accordance with specified standards to ascertain compliance of materials with requirements of Contract Documents.
 5. Promptly notify CM and CONTRACTOR of observed irregularities or deficiencies of construction.
 6. Promptly submit written report of each test and inspection: one copy each to CM, OWNER, CONTRACTOR, and one copy to file of Project Record Documents. Each report shall include:
 - a. Date issued.
 - b. Project title and number.
 - c. Testing laboratory name, address, and telephone number.
 - d. Name and signature of laboratory inspector.
 - e. Date and time of sampling or inspection.
 - f. Record of temperature and weather conditions.
 - g. Date of test.
 - h. Identification of product and Specification section.
 - i. Location of sample or test in Project.
 - j. Type of inspection or test.
 - k. Results of tests and compliance with Contract Documents.
 - l. Interpretation of test results, when requested by ENGINEER or CM.
- C. Limitations of Authority of Testing Laboratory: Laboratory is not authorized to:
1. Release, revoke, alter or enlarge on requirements of Contract Documents.
 2. Approve or accept portion of Work.
 3. Perform duties of CONTRACTOR.

1.08 CONTRACTOR'S RESPONSIBILITIES

- A. Cooperate with laboratory personnel and provide access to construction and manufacturing operations.
- B. Secure and deliver to laboratory adequate quantities of representative samples of materials proposed to be used and which require testing.
- C. Provide to laboratory preliminary mix design proposed to be used for concrete, and other materials mixes which require control by testing laboratory.
- D. Furnish copies of product test reports.
- E. Furnish Incidental Labor and Facilities:
 1. To provide access to construction to be tested.
 2. To obtain and handle samples at worksite or at source of product to be tested.
 3. To facilitate inspections and tests.
 4. For storage and curing of test samples.
- F. Notify laboratory in advance of when observations, inspections, and testing are needed for laboratory to schedule and perform in accordance with their notice of response time.
- G. Pay all costs of retesting following the second failed test of any material or product.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

SECTION 01500

TEMPORARY FACILITIES AND CONTROLS

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Furnishing, maintaining, and removing construction facilities and temporary controls, including temporary utilities, construction aids, barriers and enclosures, security, access roads, temporary controls, project sign, field offices and sheds, and removal after construction.
- B. Related Sections:
 - 1. Section 01140 - Work Restrictions.

1.02 SUBMITTALS

- A. General: For products specified to be furnished under this Section, submit product data in accordance with Section 01330.

1.03 TEMPORARY UTILITIES

- A. Temporary Electrical Power:
 - 1. Arrange with local utility to provide adequate temporary electrical service.
 - 2. Provide and maintain adequate jobsite power distribution facilities conforming to applicable Laws and Regulations.
- B. Temporary Electrical Lighting:
 - 1. In work areas, provide temporary lighting sufficient to maintain lighting levels during working hours not less than lighting levels required by OSHA and state agency which administers OSHA regulations where Project is located.
- C. Temporary Water:
 - 1. Pay for and construct facilities necessary to furnish potable water for human consumption and potable or approved non-potable water for use during construction.
 - 2. Remove temporary piping and connections and restore affected portions of the facility to original condition before final acceptance.
 - 3. Pay for water used for construction prior to final acceptance.
 - 4. Development of Potable Water Supply:
 - a. Potable water is not available at construction site.
 - b. Provide potable water for human consumption during construction period.
 - c. Furnish potable water that meets requirements of Laws and Regulations.
 - 5. Development of Construction Water Supply:
 - a. Obtain and pay for water for construction by piping or hauling from an existing source per the General Conditions.
 - b. Do not use irrigation water for potable water requirements.

- D. Temporary Sanitary Facilities:
 - 1. Provide suitable and adequate sanitary facilities that are in compliance with applicable Laws and Regulations.
 - 2. At completion of the Work, remove sanitary facilities and leave site in neat and sanitary condition.
- E. Temporary Fire Protection: Provide sufficient number of fire extinguishers of type and capacity required to protect the Work and ancillary facilities.
- F. First Aid: Provide first aid equipment and facilities and information posters conforming to requirements of OSHA and other applicable Laws and Regulations in readily accessible locations.
- G. Utilities in OWNER's Existing Facilities: See Section 01140 - Work Restrictions.

1.04 CONSTRUCTION AIDS

- A. Provide railings, kick plates, enclosures, safety devices, and controls required by Laws and Regulations and as required for adequate protection of life and property.
- B. Use construction hoists, scaffolds, stages, shoring, and similar temporary facilities of ample size and capacity to adequately support and move loads.
- C. Design temporary supports with adequate safety factor to assure adequate load bearing capability.
 - 1. When requested, submit design calculations by professional registered engineer prior to application of loads.
 - 2. Submitted design calculations are for information and record purposes only.
- D. Accident Prevention:
 - 1. Exercise precautions throughout construction for protection of persons and property.
 - 2. Observe safety provisions of applicable Laws and Regulations.
 - 3. Guard machinery and equipment, and eliminate other hazards.
 - 4. Make reports required by authorities having jurisdiction, and permit safety inspections of the Work.
 - 5. Before commencing construction Work, take necessary action to comply with provisions for safety and accident prevention.
- E. Barricades:
 - 1. Place barriers at ends of excavations and along excavations to warn pedestrian and vehicular traffic of excavations.
 - 2. Provide barriers with flashing lights after dark.
 - 3. Keep barriers in place until excavations are entirely backfilled and compacted.
 - 4. Barricade excavations to prevent persons from entering excavated areas in streets, roadways, parking lots, treatment plants, or other public or private areas.
- F. Warning Devices and Barricades: Adequately identify and guard hazardous areas and conditions by visual warning devices and, where necessary, physical barriers.
 - 1. Devices shall conform to minimum requirements of OSHA and State agency which administers OSHA regulations where Project is located.
 - 2. Provide K-rail between open trenches and traveled way along Howard Road.

- G. Hazards in Public Right-of-Way:
 - 1. At reasonable intervals, mark trenches and other continuous excavations in public right-of-way, running parallel to general flow of traffic, with traffic cones, barricades, or other suitable visual markers during daylight hours.
 - a. During hours of darkness, provide markers with torches, flashers, or other adequate lights.
 - 2. At intersections or for pits and similar excavations, where traffic may reasonably be expected to approach head on, protect excavations with continuous barricades.
 - a. During hours of darkness, provide warning lights at close intervals.
- H. Hazards in Protected Areas: Mark or guard excavations in areas from which public is excluded, in manner appropriate for hazard.
- I. Above Grade Protection: On multi-level structures, provide safety protection that meets requirements of OSHA and State agency which administers OSHA regulations where Project is located.
- J. Use substantial barricades or other devices commensurate with hazards at project site to protect existing structures, trees, shrubs, and other items to be preserved from injury, damage, or destruction by vehicles, equipment, workers, or other agents.
- K. Fences:
 - 1. Enclose temporary offices and storage areas with fence adequate to protect temporary facilities against acts of theft, violence, and vandalism.
 - a. Temporary offices may be located on the existing treatment plant site at the CONTRACTOR's option. Location will be set by the Plant's staff.
 - 2. Protect temporary and permanent openings and close openings in existing fences to prevent intrusion by unauthorized persons. Bear responsibility for protection of plant and material on site of the work when openings in existing fences are not closed.
 - 3. During night hours, weekends, holidays, and other times when no work is performed at site, provide temporary closures or enlist services of security guards to protect temporary openings.
 - 4. Fence temporary openings when openings are no longer necessary.
 - 5. Provide 5-foot high minimum, fine mesh, plastic silt and dust fencing between any planted or non-planted crop areas and the Work. Location and design of the silt fence shall be acceptable to the CM.

1.05 SECURITY

- A. Make adequate provision for protection of the Work area against fire, theft, and vandalism, and for protection of public against exposure to injury.

1.06 ACCESS ROADS

- A. General:
 - 1. Build and maintain access roads to and on site of the Work to provide for delivery of material and for access to existing and operating plant facilities on site, and for farm land use.
 - 2. Build and maintain dust free roads which are suitable for travel at 20 mph.

- B. Off-Site Access Roads:
 - 1. Build and maintain graded earth roads.
 - 2. Build roads only in public right-of-way or easements obtained by OWNER.
 - 3. Obtain rights-of-way or easements when building along other alignment.
 - 4. Maintain access roads in farming areas fully useable by farmers and others.
- C. On-Site Access Roads:
 - 1. Maintain access roads to storage and other areas where frequent access is required.
 - 2. Maintain similar roads to existing facilities of the Work site to provide access for maintenance and operation.
 - 3. Protect buried vulnerable utilities under temporary roads with steel plates, wood planking, or bridges.
 - 4. Maintain on-site access roads free of mud. Under no circumstances shall vehicles leaving the site track mud off the site onto the public right-of-way.

1.07 TEMPORARY CONTROLS

- A. Dust Control:
 - 1. Prevent dust nuisance caused by operations, unpaved roads, excavation, backfilling, demolition, or other activities.
 - 2. Control dust by sprinkling with water, use of dust palliatives, modification of operations, or other means acceptable to agencies having jurisdiction.
 - 3. Provide silt fence per Article 1.04, Paragraph K.
- B. Noise Control:
 - 1. Inhabited areas (particularly residential) Perform operations in manner to minimize noise.
 - 2. Residential areas: Take special measures to suppress noise during night hours.
- C. Mud Control:
 - 1. Prevent mud nuisance caused by construction operations, unpaved roads, excavation, backfilling, demolition, or other activities.
 - 2. Clean and sweep paved roads of any dust, mud, dirt, and debris nuisance caused by construction operations.

1.08 PROJECT SIGN

- A. Provide and maintain project identification sign consisting of: Painted, exterior-grade plywood that is approximately 8 feet wide by 4 feet high with a minimum of 10-foot long 4-by-4 lumber posts, which are set in the ground at least 3 feet deep. Using no more than five colors, a professional sign painter shall paint exhibit lettering.
 - 1. List at least the title of the Project, and names of the OWNER, ENGINEER, CM, and CONTRACTOR.
 - 2. Sign shall conform to City of Camarillo Standards.
- B. Provide lines of text printing provided by OWNER, paint appropriate dollar amounts.
- C. Erect Project identification sign along Pancho Road where directed.

1.09 FIELD OFFICES AND SHEDS

A. CONTRACTOR's Field Office:

1. Maintain on or near the Project Site weathertight space in which to keep copies of Contract Documents, progress schedule, Shop Drawings, and other relevant documents.
2. Provide field office with adequate space to examine documents, and provide lighting and telephone service in that space.
3. Provide a conference area approximately 12 feet by 16 feet with conference table and at least 10 chairs.
4. At CONTRACTOR's option, field office may be located where directed on OWNER's treatment plant site.

B. ENGINEER's Field Office:

1. Provide separate field office on Project Site for ENGINEER, as follows:
 - a. Size: Minimum 12 feet by 20 feet with 8-foot minimum ceiling height.
 - b. Construction: Weathertight building constructed at the site, pre-manufactured building, or trailer.
 - c. Walls and Ceiling: Insulated with finished interior surfaces.
 - d. Openings: At least four windows and two entrance doors, each with cylinder lock and four keys.
 - e. Exterior lighting over entrance doors.
 - f. Ten 110 volts AC duplex receptacles with at least two in each office.
2. Arrange and pay for, including monthly service costs:
 - a. Janitorial service, including daily dusting, floor cleaning, and trash removal, and monthly comprehensive cleaning, which includes windows.
 - b. Heating, ventilating, and air conditioning equipment in operating condition.
 - c. Electric wiring, power, and lighting fixtures capable of providing at least 75 foot candles of light on work surfaces.
 - d. A continuous supply of toilet paper, paper hand towels and hand soap for each restroom.
 - e. Private telephone line.
 - f. Dedicated telephone line for facsimile (fax) machine.
 - g. Dedicated telephone line for computer modem.
 - h. Bottled drinking water service with dispenser.
 - i. Suitable restroom facilities with sinks with hot and cold water.
3. Provide following furnishings and equipment:
 - a. Two office desks with six drawers (two with locks) and padded, upholstered swivel chairs.
 - b. Two plan tables not less than 36 inches by 96 inches.
 - c. Six straight chairs.
 - d. One metal filing cabinet, 18 inches by 30 inches by 52 inches, four drawers with locks.
 - e. One supply cabinet with not less than 15 square feet of shelves.
 - f. Two bookcases with not less than 12 linear feet of shelves for each bookcase.
 - g. Two wastebaskets.
 - h. Dry erase board 36 by 48 inches, magnetic.
 - i. Field Office Data Service and Equipment: Provide and pay for monthly service for one of the following data services (listed in order of preference and increasing cost) for the duration of the project. CONTRACTOR is responsible for all maintenance of service and hardware. Data service will

be dedicated to the CM and not shared with any other party. The CONTRACTOR shall provide a durable and weather tight system for connecting the CM's trailer to the service provider's facilities at the jobsite boundary.

- 1) Provide high speed Internet access (DSL or cable modem), with a minimum 512 kbps download/512kbps upload. This access must have a minimum of eight (five usable) IP address. In addition, it must provide an average round-trip delay of less than 200 ms to the CM's Internet gateway.
- 2) Provide private line or frame-relay Internet access with a minimum 384 kbps download/384k upload. This access must have a minimum of eight (five usable) IP address. In addition, it must provide an average round-trip delay of less than 200 ms to the CM's Internet gateway.
4. Locate field office on OWNER's treatment plant site where directed.
5. Have field office ready for occupancy within 2 weeks after start of sitework.

1.10 REMOVAL

- A. Remove temporary buildings and furnishings before inspection for final acceptance or when directed.
- B. Clean and repair damage caused by installation or use of temporary facilities.
- C. Remove underground installations to minimum depth of 24 inches and grade to match surrounding conditions.
- D. Restore existing facilities used during construction to specified or original condition.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

SECTION 01600

PRODUCT REQUIREMENTS

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes: Product requirements; product selection; products schedule; execution; manufacturer's instructions; and delivery, handling, and storage.

1.02 PRODUCT REQUIREMENTS

- A. Comply with Specifications and referenced standards as minimum requirements.
- B. Provide products by same manufacturer when products are of similar nature, unless otherwise specified.
- C. Provide identical products when products are required in quantity.
- D. Provide products with interchangeable parts whenever possible.

1.03 PRODUCT SELECTION

- A. When products are specified by standard or specification designations of technical societies, organizations, or associations only, provide products which meet or exceed reference standard and Specifications.
- B. When products are specified with names of manufacturers but no model numbers or catalog designations, provide:
 - 1. Products by one of named manufacturers that meet or exceed Specifications.
 - 2. Accepted or equals.
- C. When products are specified with names of manufacturers and model numbers or catalog designations, provide:
 - 1. Products with model numbers or catalog designations by one of named manufacturers.
 - 2. Accepted or equals.
- D. When products are specified with names of manufacturers, but with brand or trade names, model numbers, or catalog designations by one manufacturer only, provide:
 - 1. Products specified by brand or trade name, model number, or catalog designation.
 - 2. Products by one of the named manufacturers proven in accordance with requirements for or equals to meet or exceed quality, appearance and performance of specified brand or trade name, model number, or catalog designation.
 - 3. Accepted "or equals".

- E. When Products are specified with only one manufacturer followed by "or Equal," provide:
 - 1. Products meeting or exceeding Specifications by specified manufacturer.
 - 2. Accepted or equals.

1.04 PRODUCT OPTIONS AND SUBSTITUTIONS

- A. General: Whenever a product is specified using a name of a particular manufacturer or supplier, the specific item cited shall be understood as establishing type, function, dimension, appearance, and quality desired. Other manufacturer's products will be considered for acceptance provided sufficient information is submitted to the CM and ENGINEER for review to determine that the products proposed are equivalent to those named.

1.05 QUALITY ASSURANCE

- A. Employ entities that meet or exceed specified qualifications to execute the Work.
- B. Inspect conditions before executing subsequent portions of the Work. Accept responsibility for correcting unsatisfactory conditions upon executing subsequent portions of the Work.
- C. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, and racking.

1.06 DELIVERY, HANDLING, AND STORAGE

- A. Prepare Products for Shipment by:
 - 1. Applying grease and lubricating oil to bearings and similar items.
 - 2. Separately packing or otherwise suitably protecting bearings.
 - 3. Tagging or marking products to agree with delivery schedule or Shop Drawings.
 - 4. Including complete packing lists and bills of material with each shipment.
 - 5. Packaging products to facilitate handling and protection against damage during transit, handling, and storage.
- B. Transport products by method that avoids product damage. Deliver products in undamaged condition in manufacturer's unopened containers or packaging.
- C. Provide equipment and personnel to handle products by methods to prevent soiling or damage.
- D. Upon delivery, promptly inspect shipments. Verify compliance with Contract Documents, correct quantities and undamaged condition of products. Immediately store and protect products and materials until installed in Work.
- E. Store products with seals and legible labels intact.
- F. Store moisture sensitive products in weathertight enclosures.
- G. Maintain products within temperature and humidity ranges required or recommended by manufacturer.

- H. Connect and operate space heaters during storage when ambient temperatures fall below temperatures recommended by manufacturer.
- I. Protect painted surfaces against impact, abrasion, discoloration, and other damage. Repaint damaged painted surfaces.
- J. Exterior Storage of Fabricated Products:
 - 1. Place on above ground supports which allow for drainage.
 - 2. Cover products subject to deterioration with impervious sheet covering.
 - 3. Provide ventilation to prevent condensation under covering.
- K. Store loose granular materials on solid surfaces in well-drained area. Prevent materials mixing with foreign matter.
- L. Provide access for inspection.
- M. Maintain equipment per the manufacturer's recommendation and industry standards, including oil changes, rotation, etc. Provide a log of equipment maintenance to the CM monthly.
- N. Store HDPE and PVC pipe in covered areas, out of heat and sunlight, until within 10 days of installation.

1.07 MANUFACTURER'S INSTRUCTIONS

- A. Deliver, handle, store, install, erect, or apply products in accordance with manufacturer's instructions, Contract Documents and industry standards.
- B. Periodically inspect to assure products are undamaged and maintained under required conditions.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

SECTION 01722

FIELD ENGINEERING

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes: Field engineering to establish lines and grades for the Work.

1.02 QUALITY ASSURANCE

- A. Accuracy of alignments and grades of CONTRACTOR's work may be checked randomly by CM.
 - 1. Notice of when checking will be conducted will be given.
 - 2. When notice of checking is given, postpone parts of the Work affected by stakes, alignments, or grades to be checked until checked.
 - 3. Do not assume that CM's check substitutes or complements required field quality control procedures.

1.03 CONSTRUCTION STAKES, LINES, AND GRADES

- A. Refer also to the requirements of the General Conditions.
- B. Execute the Work in accordance with the lines and grades indicated.
- C. Make distances and measurements on horizontal planes, except elevations and structural dimensions.

1.04 SURVEY REFERENCE POINTS

- A. OWNER will provide one set of grade and offset alignment stakes. Stakes will generally be set at 100-foot intervals, angle points, connections, and other locations agreed to by OWNER.
- B. CONTRACTOR shall lay out the work based on OWNER's reference points.
- C. From these reference points, establish other control and reference points as required to properly lay out the Work.
- D. Locate and protect control points prior to starting sitework and preserve permanent reference points during construction.
 - 1. CONTRACTOR shall be responsible for protecting stakes and reference points from loss and damage.
 - 2. Make no changes or relocations without prior written notice.
 - 3. When OWNER's stakes are lost, destroyed, or moved, CONTRACTOR shall request CM to have the stakes and reference points replaced. The CONTRACTOR shall reimburse OWNER for the cost of replacement.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

SECTION 01734

WORK WITHIN PUBLIC RIGHT-OF-WAY

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes: Requirements for maintenance, support, protection, relocation, reconstruction and adjusting-to-grade, restoration, construction of temporary and new facilities, and abandonment of existing utilities affected by construction work within the public right-of-way.

1.02 REFERENCES

- A. State of California, Department of Transportation (CALTRANS).
 - 1. SS - Standard Specifications.

1.03 DEFINITIONS

- A. Utility: For purpose of this Section, utility means any public or private service, such as electric light and power systems; gas distribution systems; telephone, telegraph, cable television, and other communication services; water distribution; storm drain and sanitary sewer services; police and fire communication systems; street lighting and traffic signs and signals; parking meters; and irrigation lines.
- B. For Trenching:
 - 1. Open Trench:
 - a. General: Includes excavation, pipe laying, backfilling, and pavement replacement.
 - 2. Any excavated areas shall be considered as "open trench" until all pavement replacement has been performed or until all trenches outside of pavement replacement areas have been backfilled and compacted in accordance with these Contract Documents.

1.04 DESIGN REQUIREMENTS

- A. General:
- B. Trenching:
 - 1. Except where otherwise specified, indicated on the Drawings, or accepted in writing by the ENGINEER, the maximum length of open trench, where construction is in any stage of completion, shall not exceed the linear footage as set forth below. Descriptions under following area designations are general in nature and may be amended in writing by the ENGINEER or CM due to particular or peculiar field conditions.
 - a. Along Howard Road, east of Pancho Road: 500 Linear Feet. Less if requested by farmer.
 - b. Along the prolongation of Howard Road, west of Pancho Road: 300 Linear Feet. Less if requested by farmer.

- c. Crossing Howard Road, one half completed before second half started.
 - d. Undeveloped Areas, including undeveloped land and fallow farming areas: 600 Linear Feet.
- 2. Completely backfill trenches across streets and install temporary or permanent pavement as soon as possible after pipe laying.
- C. Site Conditions:
 - 1. Use substantial, roughened steel plates with adequate trench bracing to bridge across trenches at street and alley crossings, commercial driveways, and residential driveways where trench backfill and temporary patch have not been completed during regular working hours.
 - 2. Provide safe and convenient passage for pedestrians.
 - 3. Maintain access to fire stations, fire hydrant, and hospitals at all times.
 - 4. Provide traffic control devices, barricades, lighting, and signage as required by the regulating agency.
 - 5. Provide flagmen when required by the approved traffic control plan and as otherwise needed for safety.
 - 6. Provide flagmen for traffic control in both directions at the intersection of Pancho Road and Howard Road continuously while work within 300 feet of the intersection is in progress.
 - 7. See also the requirements for traffic control and submittals in the General Conditions.

1.05 SUBMITTALS

- A. Traffic Control Plan: Submit detailed traffic control plan for acceptance by jurisdictional agency and obtain a traffic permit from that agency before starting any work in or adjacent to public right-of-way.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

SECTION 01770
CLOSEOUT PROCEDURES

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes: Contract closeout requirements including:
 - 1. Final cleaning.
 - 2. Disinfection of systems.
 - 3. Preparation and submittal of closeout documents.
 - 4. Final completion certification.
- B. Related Sections:
 - 1. Section 01722 - Field Engineering.

1.02 FINAL CLEANING

- A. Perform final cleaning prior to inspections for Substantial Completion and Final Acceptance.
- B. Employ skilled workers who are experienced in cleaning operations.
- C. Use cleaning materials recommended by manufacturers of surfaces to be cleaned.
- D. Clean grease, mastic, adhesives, dust, dirt, stains, fingerprints, paint, blemishes, sealants, plaster, concrete, and other foreign materials from sight-exposed surfaces, fixtures, and equipment.

1.03 WASTE DISPOSAL

- A. Arrange for and dispose of surplus materials, waste products, and debris off-site.
 - 1. Prior to making disposal on private property, obtain written permission from OWNER of such property.
- B. Do not fill ditches, washes, irrigation furrows, or drainage ways that may create drainage problems.
- C. Do not create unsightly or unsanitary nuisances during disposal operations.
- D. Maintain disposal site in safe condition and good appearance.
- E. Complete leveling and cleanup prior to final acceptance of the Work.

1.04 TOUCH-UP AND REPAIR

- A. Touch-up or repair finished surfaces on structures, equipment, fixtures, and installations that have been damaged prior to inspection for Substantial Completion and Final Acceptance.
- B. Refinish or replace entire surfaces that cannot be touched-up or repaired satisfactorily.

1.05 CLOSEOUT DOCUMENTS

- A. Submit following Closeout Submittals upon Substantial Completion and at least 7 days prior to submitting Application for Final Payment:
1. Evidence of Compliance with Requirements of Governing Authorities.
 2. Project Record Documents.
 3. Operation and Maintenance Manuals.
 4. Warranties and Bonds.
 5. Evidence of Payment and Release of Liens and Stop Payment Notices as outlined in Conditions of the Contract.
 6. Release of claims as outlined in Conditions of the Contract.
 7. Survey Record Documents as specified in Section 01722.
 8. Certificate of Final Completion.
 9. Delivery receipts for spare parts and special tools.

1.06 EVIDENCE OF COMPLIANCE WITH REQUIREMENTS OF GOVERNING AUTHORITIES

- A. Submit the following:
1. Certificates of Inspection.
 2. Sign-offs on all permits.

1.07 PROJECT RECORD DOCUMENTS

- A. Maintain at Project site, available to OWNER, CM and ENGINEER, one copy of the Contract Documents, Shop Drawings, and other submittals, in good order.
1. Mark and record field changes and detailed information contained in submittals and change orders.
 2. Record actual depths, horizontal and vertical location of underground pipes, ductbanks, and other buried utilities. Reference dimensions to permanent surface features or survey data.
 3. Identify specific details of pipe connections, location of existing buried features located during excavation, and the final locations of piping, equipment, electrical conduits, manholes, and pull boxes.
 4. Identify location of spare conduits including beginning, ending, and routing through pull boxes, and manholes. Record spare conductors, including number and size, within spare conduits, and filled conduits.
 5. Provide schedules, lists, layout Drawings, and wiring diagrams.
 6. Make annotations with erasable colored pencil conforming to the following color code:

Additions:	Red
Deletions:	Green
Comments	Blue
Dimensions:	Graphite

7. All changes and findings shall be accurately drawn to scale, notated, and marked on the front face of the Record Drawings. Do not show or indicate changes by referring to Change Orders, RFIs, manufacturer's literature or other documents, or by taping sketches and other materials on the Record Drawings.

- B. Maintain documents separate from those used for construction:
 - 1. Label documents "RECORD DOCUMENTS."
- C. Mark all changes neatly, accurately, completely, and to scale on the Record Documents.
 - 1. The practice of noting changes by referencing RFIs, change orders, and similar documents will not be accepted.
- D. Keep documents current:
 - 1. Record required information at the time the material and equipment is installed and before permanently concealing.
- E. Deliver record documents with transmittal letter containing date, Project title, CONTRACTOR's name and address, list of documents, and signature of CONTRACTOR.
- F. During progress meetings, record documents will be reviewed to ascertain that changes have been recorded.
- G. Final Schedule Submittal in accordance with Section 01324B, Article "FINAL SCHEDULE SUBMITTAL."

1.08 WARRANTIES AND BONDS

- A. Provide executed Warranty or Guaranty Form if required by Contract Documents.
- B. Provide specified additional warranties, guarantees, and bonds from manufacturers and suppliers.

1.09 CERTIFICATE OF FINAL COMPLETION

- A. List of items to be completed or corrected will be amended as items are resolved by CONTRACTOR.
- B. When all items have been completed or corrected, submit written certification that the entire work is complete in accordance with the Contract Documents and request final inspection.
- C. Upon completion of final inspection, CM will either prepare a written acceptance of the entire work or advise CONTRACTOR of work not complete. If necessary, inspection procedures will be repeated.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

SECTION 02050

BASIC SITE MATERIALS AND METHODS

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes:
 - 1. Aggregate Base Course.
 - 2. Class 2 Permeable.
 - 3. Drain Rock.
 - 4. Gravel.
 - 5. Imported Fill.
 - 6. Native Material.
 - 7. Sand.
 - 8. Select Material.
 - 9. Stabilization Material.

1.02 REFERENCES

- A. ASTM International (ASTM):
 - 1. C 117 - Standard Test Method for Materials Finer than 75- μ m (No. 200) Sieve in Mineral Aggregates by Washing.
 - 2. C 131 - Standard Test Method for Resistance to Degradation of Small-Size Course Aggregate by Abrasion and Impact in the Los Angeles Machine.
 - 3. C 136 - Standard Test Method for Sieve Analysis of Fine and Course Aggregates.
 - 4. C 535 - Standard Test Method for Resistance to Degradation of Larger-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
 - 5. D 422 - Standard Test Method for Particle-Size Analysis of Soils.
 - 6. D 2419 - Standard Test Method for Sand Equivalent Value of Soils and Fine Aggregate.
 - 7. D 2844 - Standard Test Method for Resistance R-Value and Expansion Pressure of Compacted Soils.
 - 8. D 4318 - Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
 - 9. D 4829 - Standard Test Method for Expansion Index for Soils.
 - 10. D 5821 - Standard Test Method for Determining the Percentage of Fractured Particles in Coarse Aggregate.
- B. California Department of Transportation:
 - 1. Standard Specifications.
 - 2. California Test 205.
 - 3. California Test 211.
 - 4. California Test 217.
 - 5. California Test 229.
 - 6. California Test 301.

1.03 SUBMITTALS

- A. Product data:
 - 1. Material source.
 - 2. Gradation.
 - 3. Testing data.
- B. Quality control for aggregate base course:
 - 1. Test reports: Reports for tests required by Sections of Standard Specifications.
 - 2. Certificates of Compliance: Certificates as required by Sections of Standard Specifications.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Storage and protection: Protect from segregation and excessive moisture during delivery, storage, and handling.

PART 2 PRODUCTS

2.01 MATERIALS

- A. General:
 - 1. Provide material having maximum particle size not exceeding 4 inches and that is free of trash, lumber, debris, leaves, grass, roots, stumps, and other organic matter.
 - 2. Materials derived from processing demolished or removed asphalt concrete are not acceptable.
- B. Aggregate base course:
 - 1. Class 2, 3/4-inch maximum aggregate size free from organic matter and other deleterious substances, and of such nature that aggregate can be compacted readily under watering and rolling to form a firm, stable base.
 - 2. Aggregate base course for structures:
 - a. Consist of crushed or fragmented particles.
 - b. Coarse aggregate material retained in Number 4 sieve shall consist of material of which at least 25 percent by weight shall be crushed particles when tested in accordance with California Test 205.
 - 3. Aggregate shall not be treated with lime, cement, or other chemical material.
 - 4. Durability index: Not less than 35 when tested in accordance with California Test 229.
 - 5. Aggregate grading and sand equivalent tests shall be performed to represent not more than 500 cubic yards or 1 day's production of material, whichever is smaller.
 - 6. Sand equivalent: Not less than 25 when tested in accordance with California Test 217.
 - 7. Resistance (R value): Not less than 78 when tested in accordance with California Test 301.

8. Conform to size and grade within the limits as follows when tested in accordance with ASTM C 117 and ASTM C 136:

Sieve Sizes (Square Openings)	Percent by Weight Passing Sieve
1 inch	100
3/4 inch	90-100
Number 4	35-60
Number 30	10-30
Number 200	2-9

C. Class 2 permeable:

1. Durability index: Not less than 40 when tested in accordance with California Test 229.

D. Drain rock:

1. Durability index: Not less than 40 when tested in accordance with California Test 229.
2. Consist of hard, durable particles of stone or gravel, screened or crushed to specified size and gradation.
3. Free from organic matter, lumps or balls of clay, or other deleterious matter.
4. Crush or waste coarse material and waste fine material as required to meet gradation requirements.
5. Conform to size and grade within the limits as follows when tested in accordance with ASTM C 117 and C 136:

Sieve Size (Square Openings)	Percent By Weight Passing Sieve
2 inch	100
1-1/2 inch	95-100
3/4 inch	50-100
3/8 inch	15-55
Number 200	0-2

E. Gravel:

1. Consist of hard, durable particles of stone or gravel, screened or crushed to the specified sizes and gradations.
2. Free of organic matter, lumps or balls of clay, and other deleterious matter.
3. Crush or waste coarse material, and add or waste fine material in order to meet the specified gradations.
4. Fraction of material passing number 40 sieve: Material having plasticity index not greater than 5 when tested in accordance with ASTM D 4318.
5. Durability percentage of wear not greater than 40 percent when tested in accordance with California Test 211.

6. Conform to sizes and grade within the limits as follows when tested in accordance with ASTM C 117 and C 136:

Sieve Size (Square Openings)	Percent by Weight Passing Sieve		
	Type A	Type B	Type C
2 inch	100	--	--
1-1/2 inch	95-100	100	--
3/4 inch	35-60	55-85	100
3/8 inch	15-40	35-65	50-100
Number 4	0-25	20-35	30-45
Number 30	--	5-15	10-20
Number 200	0-5	2-9	2-9

F. Imported material:

1. Meeting requirements for select material.

G. Native material:

1. Sound, earthen material passing 1-inch sieve.
2. Percent of material by weight passing Number 200 sieve shall not exceed 30 when tested in accordance with ASTM D 422.
3. Expansion index less than 35 when tested in accordance with ASTM D 4829.

H. Sand:

1. Clean, coarse, natural sand.
2. Nonplastic when tested in accordance with ASTM D 4318.
3. One hundred percent shall pass a 1/2-inch screen.
4. No more than 20 percent shall pass a Number 200 sieve.

I. Select material:

1. Sound earthen material for which sum of plasticity index when tested in accordance with ASTM D 4318 and the percent of material by weight passing Number 200 sieve shall not exceed 23 when tested in accordance with ASTM D 422.
2. Organic content shall not be greater than 3 percent by volume.

J. Stabilization material:

1. Durability percentage of wear not greater than 40 percent when tested in accordance with California Test 211.
2. Consist of clean, hard, durable particles of crushed rock or gravel screened or crushed to the specified sizes and gradations.
3. Shall be free of any detrimental quantity of soft, friable, thin, elongated, or laminated pieces, disintegrated material, organic matter, oil, alkali, or other deleterious substance.
4. Shall be free of slaking or decomposition under the action of alternate wetting and drying.

5. The portion of material retained on the 3/8-inch sieve shall contain at least 50 percent of particles having three or more fractured faces. Not over 5 percent shall be pieces that show no such faces resulting from crushing. Of that portion which passes the 3/8-inch sieve but is retained on the No. 4 sieve, not more than 10 percent shall be pieces that show no faces resulting from crushing.
6. Conform to size and grade when tested in accordance with ASTM C 117 and ASTM C 136.

Sieve Size (Square Openings)	Percent by Weight Passing Sieve
1 inch	100
3/4 inch	90-100
Number 4	0-10
Number 200	0-2

2.02 SOURCE QUALITY CONTROL

- A. Provide test result showing that material meets specified material properties.

PART 3 EXECUTION

Not Used.

END OF SECTION

SECTION 02200
SITE PREPARATION

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes: Clearing, grubbing, and stripping project site.
- B. Related sections:
 - 1. The Contract Documents are complementary; what is called for by one is as binding as if called for by all.
 - 2. It is the CONTRACTOR's responsibility for scheduling and coordinating the Work of subcontractors, suppliers, and other individuals or entities performing or furnishing any of CONTRACTOR's Work.
 - 3. The following Sections are related to the Work described in this Section. This list of Related Sections is provided for convenience only and is not intended to excuse or otherwise diminish the duty of the CONTRACTOR to see that the completed Work complies accurately with the Contract Documents.
 - a. Section 01354 - Hazardous Materials Procedures.
 - b. Section 02050 - Basic Site Materials and Methods.

1.02 REFERENCES

- A. Title 40, Code of Federal Regulations:
 - 1. Part 503 - Standards for the Use or Disposal of Sewage Sludge.

1.03 DEFINITIONS

- A. Clearing: Consists of removal of natural obstructions and existing foundations, buildings, fences, lumber, walls, stumps, brush, weeds, rubbish, trees, boulders, utility lines, and any other items which interferes with construction operations or are designated for removal.
- B. Grubbing: Consists of the removal and disposal of wood or root matter below the ground surface remaining after clearing and includes stumps, trunks, roots, or root systems greater than 1 inch in diameter or thickness to a depth of 6 inches below the ground surface.
- C. Stripping: Includes the removal and disposal of all organic sod, topsoil, grass and grass roots, and other objectionable material remaining after clearing and grubbing from the areas designated to be stripped. The depth of stripping is estimated to be 6 inches, but the required depth of stripping will be determined by the CM.

1.04 QUALITY ASSURANCE

- A. Regulatory requirements: Verify and comply with applicable regulations regarding those governing noise, dust, nuisance, drainage and runoff, fire protection, and disposal.
- B. Pre-construction conference: Meet with CM to discuss order and method of work.

1.05 PROJECT CONDITIONS

- A. Environmental requirements:
 - 1. For suspected hazardous materials found, comply with Section 01354.
- B. Existing conditions:
 - 1. Verify character and amount of clay, sand, gravel, quicksand, water, rock, hardpan, and other material involved and work to be performed.

1.06 SEQUENCING AND SCHEDULING

- A. Clearing and grubbing: Perform clearing and grubbing in advance of grading operations.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verification of conditions: Examine site and verify existing conditions for beginning work.

3.02 PREPARATION

- A. Protect existing improvements from damage by site preparation work. Install fence at drip line of trees to remain as indicated on the Drawings.

3.03 INSTALLATION

- A. Clearing:
 - 1. Clear areas where construction is to be performed and other areas as indicated on the Drawings, or specified in this Section, of fences, lumber, walls, stumps, brush, roots, weeds, trees, shrubs, rubbish, and other objectionable material of any kind which, if left in place, would interfere with proper performance or completion of the work, would impair its subsequent use, or form obstructions.
 - 2. Do not incorporate organic material from clearing and grubbing operations in fills and backfills.
 - 3. CONTRACTOR's construction facilities: Fill or remove pits, fill, and other earthwork required for erection of facilities, upon completion of the work, and level to meet existing contours of adjacent ground.
- B. Grubbing:
 - 1. From excavated areas: Grub stumps, roots, and other obstructions 3 inches or over in diameter to depth of not less than 18 inches below finish grade.

2. In embankment areas or other areas to be cleared outside construction area: Do not leave stumps, roots, and other obstructions higher than the following requirements:

Height of Embankment over Stump	Depth of Clearing and Grubbing
0 feet to 2 feet	Grub stumps or roots 3 inches or over in diameter to 18 inches below original grade. Cut others flush with ground.
2 feet to 3 feet	Grub stumps 1 foot and over in diameter to 18 inches below original grade. Cut others flush with ground.
Over 3 feet	Leave no stumps higher than stump top diameter, and in no case more than 18 inches.

3. Backfill and compact cavities left below subgrade elevation by removal of stumps or roots to density of adjacent undisturbed soil.

C. Stripping:

1. Remove soil material containing sod, grass, or other vegetation to depth of 6 inches from areas to receive fill or pavement and from area within 5 feet outside foundation walls.
2. Deposit stripped material in accordance with following requirements:
 - a. At locations as accepted.
 - b. Use accepted material in top 6 inches of areas to be used for future planting.
3. Replace topsoil where indicated on the Drawings.

END OF SECTION

SECTION 02240

DEWATERING

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes:
 - 1. Installation and maintenance of dewatering systems.
 - 2. Disposal of water entering excavation or other parts of the work.
- B. Related sections:
 - 1. The Contract Documents are complementary; what is called for by one is as binding as if called for by all.
 - 2. It is the CONTRACTOR's responsibility for scheduling and coordinating the Work of subcontractors, suppliers, and other individuals or entities performing or furnishing any of CONTRACTOR's Work.
 - 3. The following Sections are related to the Work described in this Section. This list of Related Sections is provided for convenience only and is not intended to excuse or otherwise diminish the duty of the CONTRACTOR to see that the completed Work complies accurately with the Contract Documents.
 - a. Section 03300 - Cast-in-Place Concrete.
 - b. Section 03600 - Grouts.

1.02 SYSTEM DESCRIPTION

- A. Design requirements:
 - 1. Keep excavations reasonably free from water. Draw down the static water level to a minimum of 3 feet below the bottom of excavations.
 - 2. Analysis includes the following: Evaluation of the anticipated subsurface conditions, required well spacing, diameter of wells, depth screen interval, backfill and filter pack, pump size, drawdown duration, drawdown and steady state flow rates, desilting tank, and settlements.
 - 3. Include water drawdown curves in dewatering calculations.
 - 4. Coordinate dewatering design with excavation and shoring design. Recognize the changes in groundwater conditions and earth pressures in the shoring and excavation design.
 - 5. Do not place concrete or masonry foundations or floors in water, nor allow water to rise over them until concrete or mortar has set at least 24 hours.
 - 6. Maintain operation of the dewatering system until the complete structure including walls, slabs, beams, struts, and all other structural elements have been constructed and the concrete has attained specified strength, and backfill has been completed to finish grade.
 - 7. Provide standby power to ensure continuous dewatering in case of power failure.
- B. Secure written permission from the ENGINEER before locating wells, well points, or drain lines for purposes of dewatering within limits of structure foundation.

- C. Locate dewatering facilities where they will not interfere with roadways, farm access, utilities, and construction work to be performed by others.
- D. Open manholes will not be allowed for discharge piping. Obtain approval of each discharge location from the ENGINEER.

1.03 SUBMITTALS

- A. Dewatering plan:
 - 1. Arrangement, location, depths of system components.
 - 2. Type and sizes of filters.
 - 3. Required permits.
- B. Well construction logs which include:
 - 1. Descriptions of actual materials encountered in accordance with Unified Soil Classification System.
 - 2. Construction details.
 - 3. Well development procedures and results.
 - 4. Deviations from original design.
- C. Laboratory test results.
- D. Identify the proposed alignment of the discharge pipe and method of for the pipe to enter the manhole. Provide details of the pipe entering the manhole.
- E. Qualifications:
 - 1. Dewatering contractor.
 - 2. Dewatering design engineer.
 - 3. Testing laboratory.

1.04 QUALITY ASSURANCE

- A. Qualifications of a dewatering design engineer:
 - 1. Dewatering plan and dewatering system analysis:
 - a. Prepared by a registered Civil Engineer, registered in the state where the Project is located. The Civil Engineer must have at least 8 years of experience in designing similar systems.
 - b. Submit qualifications of the dewatering contractor, the Dewatering Design Engineer, sampling service, and testing laboratory.
- B. Regulatory requirements:
 - 1. Assume responsibility for obtaining water discharge permits that are required.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Provide and maintain during construction: Ample means and devices with which to promptly remove and properly dispose of water entering excavation or other parts of the work, whether water is surface water or underground water.
- B. Install at least 1 groundwater level monitoring well. If more than 4 dewatering wells or well points are installed, install 1 additional monitoring well for every 4 dewatering wells or well points.
 - 1. Locate monitoring wells within 6 feet of the excavation and located mid way between dewatering wells or well points.
 - 2. Monitoring wells: Temporary cap and be not less than 2 inches in diameter.
 - 3. Protect the dewatering wells in place during the excavation.
- C. Intercept and divert precipitation and surface water away from excavations through the use of dikes, curb walls, ditches, pipes, sumps, or other means.
- D. Disposing of water:
 - 1. Dispose of water from the work in suitable manner without damage to adjacent property.
 - 2. Do not drain water into work built or under construction.
 - 3. Dispose of water in such manner as not to be menace to public health.
- E. Wells, well points, and drain lines for dewatering:
 - 1. Locate after receiving ENGINEER's written permission.
 - 2. Fill dewatering wells, pipes, and french drains to be left in place within structure foundation limits with Class "C" concrete as specified in Section 03300 or grout as specified in Section 03600.

3.02 CONSTRUCTION

- A. Interface with other work:
 - 1. Prior to release of groundwater to its static level:
 - a. All groundwater pressure relief devices for the structure are fully operational.
 - b. Construction of structure complete and the concrete has reached specified strength.
 - c. Backfill of structure is complete.
 - d. Control release of groundwater to its static level to prevent disturbance of the natural foundation soils or compacted backfills and fills and to prevent flotation or movement of structures or pipelines.

3.03 FIELD QUALITY CONTROL

- A. Monitoring wells:
 - 1. Record water levels at least once a week. Submit readings to ENGINEER within 1 week.

END OF SECTION

SECTION 02260

EXCAVATION SUPPORT AND PROTECTION

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes: Requirements for designing, furnishing and installing, maintaining, and removing excavation support and protection.
- B. Related Sections:
 - 1. Section 01410 - Regulatory Requirements.

1.02 REFERENCES

- A. American Institute of Steel Construction, Inc. (AISC):
 - 1. Manual of Steel Construction Allowable Stress Design.
- B. American Society of Civil Engineers:
 - 1. Guidelines of Engineering Practice for Braced and Tied-Back Excavations.
- C. California Code of Regulations (CCR):
 - 1. Title 8 - Construction Safety Orders.
- D. California Labor Code Sections 6705 to 6707 (CLC).
- E. Department of the Navy Naval Facilities Engineering Command (NAVFAC):
 - 1. Design Manual 7.2 - Foundations and Earth Structures.
 - 2. Design Manual 7.3 - Soil Dynamics Deep Stabilization and Special Geotechnical Construction.
- F. State of California Department of Transportation (Caltrans):
 - 1. Caltrans California Trenching and Shoring Manual.
- G. United States Steel Corporation (USS):
 - 1. Steel Sheet Piling Design Manual.

1.03 DEFINITIONS

- A. General Engineering Design Practice: General engineering design practice in area of the Project, performed in accordance with recent engineering literature on subject of shoring and stability of excavations.
- B. Shoring: A temporary structural system designed to support vertical faces, or nearly vertical faces, of soil or rock for purposes of excavation. Shoring includes cantilevered sheet piling, internally braced sheet piling, slurry walls, soldier piles and lagging, and other similar shoring systems. Sloping of the soil is not shoring.

1.04 SYSTEM DESCRIPTION

- A. Where General Engineering Design Practice is specified, provide drawings and signed calculations and have design performed by civil or structural engineer registered in State where the Project is located:
 - 1. Provide design calculations that clearly disclose assumptions made, criteria followed, and stress values used for the materials being used.
 - 2. Furnish references acceptable to ENGINEER substantiating appropriateness of design assumptions, criteria, and stress values.
- B. Design Requirements:
 - 1. General:
 - a. Design means for safe and stable excavations in accordance with general engineering design practice:
 - 1) The preceding requirement shall not apply to trench excavation support conforming to standards set forth in CCR Title 8 - Construction Safety Orders.
 - b. Design steel members in accordance with the building code as specified in Section 01410 and the AISC Manual of Steel Design.
 - c. Design shoring involving materials other than steel in accordance with building code as specified in Section 01410.
 - d. Perform design in accordance with soil characteristics and design recommendations contained in a written geotechnical report issued and signed by a geotechnical engineer hired by the CONTRACTOR. Geotechnical engineer shall be registered in the State where the Project is located:
 - 1) Make copy of geotechnical report available at project site for ENGINEER's review.
 - 2) Retain and pay for geotechnical engineer's services.
 - 3) Obtain report based on soil samples, field and laboratory tests, and borings performed for the geotechnical report for the design of stability of excavations by the geotechnical engineer hired by CONTRACTOR.
 - e. When electing to design with material stresses for temporary construction higher than allowable stresses prescribed in the Manual of Steel Construction and the building code as specified in Section 01410, increase in such stresses shall not exceed 10 percent of value of prescribed stresses.
 - f. Minimum safety factor used for design shall not be less than 1.5.
 - g. The calculated minimum depth of penetration of shoring below the bottom of the excavation shall be increased not less than 30 percent if the full value of passive pressure is used in the design.
 - h. The maximum height of cantilever shoring above the bottom of excavation shall not exceed 15 feet. Use braced shoring when the height of shoring above the bottom of excavation exceeds 15 feet.
 - i. The location of the point of fixity for shoring shall not be less than half the calculated minimum embedment depth below the bottom of the excavation.
 - j. Generally acceptable references for the design of shoring and excavations are as follows:
 - 1) Caltrans California Trenching and Shoring Manual.
 - 2) NAVFAC Design Manual 7.2 - Foundations and Earth Design.

- 3) NAVFAC Design Manual 7.3 - Soil Dynamics Deep Stabilization and Special Geotechnical Construction.
- 4) USS Steel Sheet Piling Design Manual.
- 5) Guidelines of Engineering Practice for Braced and Tied-Back Excavations published by American Society of Civil Engineers.
- k. The maximum total deflection at any point on the shoring shall not be more than 3/4 inch.
- l. The shoring design firm shall obtain errors and omissions insurance for the Project for an amount of not less than \$1,000,000.
- 2. Soldier Piles and Lagging:
 - a. Provide lagging over the full face of the excavation. Joints between pieces of lagging shall be tight to prevent loss of soil.
 - b. Provide full face lagging all around penetrations through the lagging.
 - c. If the soldier piles are installed in predrilled holes, the predrilled holes shall be filled with control density backfill after the soldiers piles are installed.
 - d. The effective width of driven soldier piles for passive soil resistance shall not exceed 2 times the width of the pile. The effective width of concrete encased soldier piles for passive soil resistance shall not exceed 2 times the width of the concrete encasement.
 - e. Fill voids behind lagging with gravel or other material acceptable to the ENGINEER.
 - f. Apply loads from tie back soil, rock, or deadman anchors concentrically to soldier piles or wales spanning between soldier piles. Wales shall be back-to-back double channels or other members acceptable to the ENGINEER. Eccentrically loaded with section soldier piles or wales are not acceptable.
 - g. Design soldier piles for downward loads including vertical loads from tie back anchors.
- 3. Soil Anchors, Rock Anchors, and Deadmen Anchors:
 - a. Design tie back anchors for a safety factor of not less than 2 times the calculated load from the shoring.
 - b. Proof load all production anchors to not less than **[125] [150]** percent of the calculated load from the shoring. Lock off anchors at the calculated anchor load.
 - c. The length of soil anchors used to calculate resistance to load from the shoring, shall not include any length within the potential active pressure soil failure zone behind the face of shoring.
 - d. Design tie rods for anchors for 130 percent of the calculated load from the shoring.
 - e. Design tie rods for anchors for 150 percent of the calculated load from the shoring when tie rod couplers are used and for other conditions where stress concentrations can develop.

C. Performance Requirements:

- 1. General:
 - a. Support faces of excavations and protect structures and improvements in vicinity of excavations from damage and loss of function due to settlement or movement of soils, alterations in ground water level caused by such excavations, and related operations.

- b. Herein Specified Provisions:
 - 1) Complement, but do not substitute or diminish, obligations of CONTRACTOR for the furnishing of a safe place of work pursuant to provisions of the Occupational Safety and Health Act of 1970 and its subsequent amendments and regulations and for protection of the Work, structures, and other improvements.
 - 2) Represent Minimum Requirement for:
 - a) Number and types of means needed to maintain soil stability.
 - b) Strength of such required means.
 - c) Methods and frequency of maintenance and observation of means used for maintaining soil stability.
- 2. Provide safe and stable excavations by means of sheeting, shoring, bracing, sloping, and other means and procedures, such as draining and recharging groundwater and routing and disposing of surface runoff, required to maintain the stability of soils and rock.
- 3. Provide support for trench excavations for protection of workers from hazard of caving ground.
- 4. Provide Shoring:
 - a. Where, as result of excavation work and analysis performed pursuant to general engineering design practice, as defined in this Section:
 - 1) Excavated face or surrounding soil mass may be subject to slides, caving, or other types of failures.
 - 2) Stability and integrity of structures and other improvements may be compromised by settlement or movement of soils, or changes in soil load on structures and other improvements.
 - b. For trenches 5 feet and deeper.
 - c. For trenches less than 5 feet in depth, when there is a potential for cave-in.
 - d. Where indicated on the Drawings.
- 5. For safe and stable excavations, use appropriate design and procedures for construction and maintenance to minimize settlement of supported ground and to prevent damage to structures and other improvements, including:
 - a. Using stiff support systems.
 - b. Following appropriate construction sequence.
 - c. Preventing Soil Loss through or under Support System:
 - 1) Provide support system that is tight enough to prevent loss of soil and extend deep enough to prevent heave or flow of soils from supported soil mass into the excavation.
 - d. Providing surface runoff routing and discharge away from excavations.
 - e. Where dewatering is necessary, recharge groundwater as necessary to prevent settlement in area surrounding excavation.
 - f. Where sheet piling is used, use interlocking type sheets. The sheet piles shall be continuous and driven in interlock. If the bottom of the excavation is located below the water table, use "thumb and finger" type interlock.
 - g. Not applying shoring loads to existing structures and other improvements.
 - h. Not changing existing soil loading on existing structures and other improvements.
 - i. Provide welded steel packing between soil retaining members such as sheet piles and wales and similar members when the gap exceeds 1/4 inch before the wales are loaded.

1.05 SUBMITTALS

- A. Shop Drawings and Calculations:
 - 1. In accordance with requirements in California Labor Code for trench excavations 5 feet or more in depth and for trenches less than 5 feet in depth when there is potential for cave-in. Submit in advance of excavation work, detailed drawings showing means for safe and stable excavations:
 - a. Where such drawings vary from excavation support standards set forth in California Code of Regulations Title 8 - Construction Safety Orders, submit design calculations pursuant to general engineering design practice.
 - b. Provide means for safe and stable excavations that are not less effective than required in CCR Title 8 - Construction Safety Orders.
 - 2. For excavations other than trenches, submit, in advance of excavation work, design calculations as performed pursuant to general engineering design practice, as specified in this Section, and detail drawing showing means for safe and stable excavations. In design calculations and detail drawing, cover, as a minimum:
 - a. Excavations adjacent to structures and other improvements, and
 - b. Excavations 5 feet or more in depth, or less than 5 feet in depth when there is potential for cave-in, at other locations.
 - 3. Submit Following:
 - a. Provide calculations for the different load, support, and other conditions that occur during the sequence of installation of shoring, construction of facilities protected by the shoring, and sequence of removal of shoring.
 - b. Provide sketches showing the condition at various stages of installation and removal of shoring.
 - c. Show structures, pipelines, and other improvements located near the shoring, and the shoring on a plan.
 - d. When utilities penetrate the shoring, submit an elevation of all sides of the shoring showing the locations of the penetrations. Submit details on ground support and sealing around utility penetrations.
- B. Written geotechnical report on soil characteristics and design recommendations, as specified in this Section.
- C. Control Points and Schedule of Measurements:
 - 1. Submit location and details of control points and method and schedule of measurements in accordance with requirements of this section.
 - 2. Promptly upon constructing control points and making measurements at such control points, as specified in this Section, submit copy of field notes with such measurements. The field notes shall show the current measurement and the change in measurement from the first measurement taken.
- D. Detailed Sequence of Installation and Removal of Shoring:
 - 1. Consider effects of ground settlement in the sequence of installation and removal of shoring.
 - 2. Provide sketches showing the conditions at various stages in the sequence of installation and removal of shoring.
- E. Submit submittals for stability of excavations as a complete package and include all items required in this section. Incomplete submittals will not be reviewed and will be returned for resubmittal as a complete package.

1.06 SEQUENCING AND SCHEDULING

- A. Do not begin work on excavations, trenches, and means for providing stability of excavation and trenches until submittals have been accepted by ENGINEER and until materials necessary for installation are on site.
- B. Submit submittals a minimum of 60 days prior to the scheduled date to begin excavation work.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

3.01 INSTALLATION AND REMOVAL

- A. Install means for providing safe and stable excavations as indicated in the submittals.
- B. Except for concrete encased soldier piles, slurry walls, and similar shoring systems, remove shoring by completion of the Work. Select shoring system and method of removal, which will minimize soil that sticks to shoring from creating large voids and causing settlement. To prevent settlement caused by pulling shoring, fill voids with sand, pea gravel, or pressure injected grout. The methods used shall prevent settlement. Pressure preservative treated wood lagging may be left in place when acceptable to the ENGINEER.

3.02 MAINTENANCE

- A. Where loss of soil occurs, plug gap in shoring and replace lost soil with fill material acceptable to ENGINEER.
- B. Where measurements and observations indicate possibility of failure or excessive movement of excavation support, determined in accordance with general engineering design practice, take appropriate action immediately.

3.03 CONTROL POINTS

- A. Establish control points on shoring and on structures and other improvements in vicinity of excavation for measurement of horizontal and vertical movement:
 - 1. Set Control Points on Shoring Support System:
 - a. Set points at distances not exceeding 25 feet at each support level.
 - b. Support levels shall be levels of tie-backs, wales, bottom of excavation, and other types of supports.

END OF SECTION

SECTION 02300

EARTHWORK

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes:
 - 1. Loosening, excavating, filling, grading, borrow, hauling, preparing subgrade, compacting in final location, wetting and drying, and operations pertaining to site grading for buildings, basins, reservoirs, boxes, roads, and other facilities.
 - 2. Backfilling and compacting under and around structures.
- B. Related sections:
 - 1. The Contract Documents are complementary; what is called for by one is as binding as if called for by all.
 - 2. It is the CONTRACTOR's responsibility for scheduling and coordinating the Work of subcontractors, suppliers, and other individuals or entities performing or furnishing any of CONTRACTOR's Work.
 - 3. The following Sections are related to the Work described in this Section. This list of Related Sections is provided for convenience only and is not intended to excuse or otherwise diminish the duty of the CONTRACTOR to see that the completed Work complies accurately with the Contract Documents.
 - a. Section 02050 - Basic Site Materials and Methods.
 - b. Section 02240 - Dewatering.
 - c. Section 02312 - Controlled Low-Strength Materials (CLSM).
 - d. Section 02620 - Filter Fabric.
 - e. Section 02621 - Stabilization Fabric.
 - f. Section 03200 - Concrete and Reinforcement.

1.02 REFERENCES

- A. ASTM International (ASTM):
 - 1. D 1556 - Standard Test Method for Density and Unit Weight of Soil in Place by the Sand Cone Method.
 - 2. D 1557 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³ (2,700 kN m/m<sup>3 - 3. D 2922 - Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
 - 4. D 3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).</sup>

1.03 DEFINITIONS

- A. Backfill adjacent to structure: Backfill within volume bounded by the exterior surfaces of structure, the surface of undisturbed soil in the excavation around structure, and finish grade around structure.
- B. Embankments: Dikes, levees, berms, and similar facilities.

- C. Excavation: Consists of loosening, removing, loading, transporting, depositing, and compacting in final location, wet and dry materials, necessary to be removed for purposes of construction of structures, ditches, grading, roads, and such other purposes as are indicated on the Drawings.

1.04 SYSTEM DESCRIPTION

- A. Performance requirements:
 - 1. Where mud or other soft or unstable material is encountered, remove such material and refill space with stabilization material. Wrap stabilization material with stabilization fabric.
 - 2. Obtain acceptable import material from other sources if surplus or borrow materials obtained within Project site do not conform to specified requirements or are not sufficient in quantity.
 - 3. No extra compensation will be made for hauling of fill materials nor for water required for compaction.

1.05 SUBMITTALS

- A. Copy of Property Owner's Agreement allowing placement of surplus soil material on their property.
- B. Excavation plan: Submit proposed excavation plan.
- C. Test reports:
 - 1. Submit certified test reports of all tests specified to be performed by the CONTRACTOR.
 - 2. Sign and seal test reports by a registered Geotechnical Engineer in the State where the Project is located.

1.06 QUALITY ASSURANCE

- A. Initial compaction demonstration:
 - 1. Adequacy of compaction equipment and procedures: Demonstrate adequacy of compaction equipment and procedures before exceeding any of following amounts of earthwork quantities:
 - a. 200 LF of trench backfill.
 - b. 100 cubic yards of embankment work.
 - c. 100 cubic yards of fill.
 - d. 50 cubic yards of roadway base material.
 - e. 100 cubic yards of road fill.
 - 2. Compaction sequence requirements: Until specified degree of compaction on previously specified amounts of earthwork is achieved, do not perform additional earthwork of the same kind.
 - 3. After satisfactory conclusion of initial compaction demonstration and at any time during construction, provide confirmation tests as specified under "FIELD QUALITY CONTROL."

1.07 SEQUENCING AND SCHEDULING

- A. Schedule earthwork operations to meet requirements specified in this Section for excavation and uses of excavated material.

- B. If necessary, stockpile excavated material in order to use it at specified locations.
- C. Excavation, backfilling, and filling: Perform excavation, backfilling, and filling during construction in manner and sequence that provides drainage at all times.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Water for compacting: Use water from source acceptable to ENGINEER.
- B. Soil and rock materials:
 - 1. General:
 - a. Provide aggregate base course, Class 2 permeable, controlled low-strength material, drain rock, gravel, native material, sand, select material, and stabilization material where specified or indicated on the Drawings.
 - b. If suitable surplus materials are available, obtain native material and select material from cut sections or excavations or imported materials.
 - 2. Aggregate base course materials: As specified in Section 02050.
 - 3. Class 2 permeable: As specified in Section 02050.
 - 4. Drain rock: As specified in Section 02050.
 - 5. Gravel: As specified in Section 02050.
 - 6. Native material: As specified in Section 02050.
 - 7. Sand: As specified in Section 02050.
 - 8. Select material: As specified in Section 02050.
 - 9. Stabilization material: As specified in Section 02050.
- C. CLSM: As specified in Section 02312.
- D. Geotextile fabrics:
 - 1. Filter fabric: As specified in Section 02620.
 - 2. Stabilization fabric: As specified in Section 02621.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verification of conditions:
 - 1. Character and quantity of material:
 - a. Verify character and quantity of rock, gravel, sand, silt, water, and other inorganic or organic materials to be encountered in work to be performed.
 - b. Determine gradation and shrinkage, and swelling of soil, and suitability of material for use intended in work to be performed.
 - c. Determine quantity of material, and cost thereof, required for construction of backfills, cuts, embankments, excavations, fills, and roadway fills, whether from onsite excavations, or imported materials. Include in cost of work to be performed.
 - d. Include wasting of excess material, if required, in cost of work to be performed.

3.02 PREPARATION

A. Backfills:

1. After clearing and excavation are completed, scarify entire areas which underlie backfills or structures to a depth of 6 inches and until surface is free of ruts, hummocks, and other features which would prevent uniform compaction by equipment to be used.
2. Recompect scarified areas to density specified before placing backfill material or concrete.
3. If foundation areas have cemented rock, cobbles, or boulders do not scarify the top 6 inches prior to compaction. Moisten the native soil and compact the coarse fill as specified in this Section.
4. Do not place backfill against walls until:
 - a. Walls have been cast full height of structure and concrete has reached the specified strength.
 - b. Connecting slabs and beams have been cast and concrete has reached the specified strength.
5. Prior to backfilling:
 - a. Remove all forms
 - b. Clean all trash and debris from the excavation site.
6. After inspection of foundation, walls, and pipes, place backfill symmetrically around structures to prevent eccentric loading of structures.

B. Embankments:

1. After clearing is completed, scarify entire areas which underlie embankments to a depth of 6 inches and until surface is free of ruts, hummocks, and other features which would prevent uniform compaction by equipment to be used.
2. Recompect scarified areas to density specified for embankments before placing of embankment material.
3. If embankment areas have cemented rock, cobbles, or boulders, do not scarify the top 6 inches prior to compaction. Moisten the native soil and compact the coarse fill as specified in this Section.

C. Fills:

1. After clearing is completed, scarify entire areas which underlie fill sections or structures to a depth of 6 inches and until surface is free of ruts, hummocks, and other features which would prevent uniform compaction by equipment to be used.
2. Recompect scarified areas to density specified for compacted fills before placing of fill material or concrete.
3. If fill areas have cemented rock, cobbles, or boulders, do not scarify the top 6 inches prior to compaction. Moisten the native soil and compact the coarse fill as specified in this Section.

D. Roadway fills:

1. After clearing is completed, scarify entire areas which underlie roadway fills to a depth of 6 inches and until surface is free of ruts, hummocks, and other features which would prevent uniform compaction by equipment to be used.
2. Recompect scarified areas to density specified for roadway fills before placing of roadway fill material.
3. If roadway fill areas have cemented rock, cobbles, or boulders, do not scarify the top 6 inches prior to compaction. Moisten the native soil and compact the coarse fill as specified in this Section.

- E. Sloped surfaces for fill or foundations:
 - 1. Foundations for fill having slopes in excess of 1 vertical to 4 horizontal:
 - a. Bench or terrace to adequately key existing ground and fill built thereon.
 - 2. Slopes of original hillsides and old fills: Bench minimum of **[10]** **[_____]** feet horizontally as fill is placed.
 - 3. Provision of new benches:
 - a. Start new bench wherever vertical cut of next lower bench intersects existing grade.
 - b. Recompect material thus cut out along with new embankment material at no additional cost to the OWNER.

3.03 INSTALLATION

- A. General:
 - 1. Dispose of excavated materials which are not required or are unsuitable for fill and backfill in lawful manner.
 - 2. Dispose of surplus material on private property only when written permission agreement is furnished by owner of property. Submit copies of such agreements.
 - 3. Rocks, broken concrete, or other solid materials larger than 4 inches in greatest dimension: Remove from project site at no additional cost to OWNER.
 - 4. Stabilization of subgrade: Provide materials used, or perform work required, to stabilize subgrade so it can withstand loads which may be placed upon it by CONTRACTOR's equipment.
- B. Borrow area: There is no borrow area on Project site.
 - 1. Where material is required, import material from source located off Project site selected by the CONTRACTOR and subject to acceptance by the ENGINEER.
 - 2. There will be no additional cost to the Contract for use of imported material.
- C. Compaction:
 - 1. Provide specified compaction for backfills, cuts, embankments, fills, roadway fills, and other earthwork.
 - 2. Perform confirmation tests to verify and confirm that work has complied, and is complying at all times, with compaction requirements specified in this Section for initial compaction demonstration and field quality control testing.
 - 3. In-place density of compacted backfills, cuts, embankments, fills, and roadway fills determined in accordance with ASTM D 1556, or with ASTM D 2922 and ASTM D 3017.
 - 4. Maximum density obtained in laboratory when tested in accordance with ASTM D 1557.
 - 5. To prevent damage to structures due to backfilling operations, place backfill with equipment that does not exceed H-20 loading, within a distance from the face of the structure of not less than 1/2 the depth of backfill. The depth of backfill is the distance between the level being compacted and the bottom of the excavation. Outside this distance, heavier compaction equipment may be used.
 - 6. Compact to percentage of maximum density as follows:
 - a. Backfill adjacent to structures: 95 percent.
 - b. Backfilling voids: 95 percent.
 - c. Embankments: 95 percent.
 - d. Demolition areas: 95 percent.

- e. Other areas: 90 percent.
- f. Under present and future structures: 95 percent.
- g. Under roadways, parking and storage areas, curbs, and sidewalks: 95 percent.
- h. Upper 6 inches of cuts: 95 percent.
- i. Fills: 95 percent.

D. Dewatering: As specified in Section 02240.

E. Excavation:

- 1. Blasting: Not permitted.
- 2. Excavations for structures:
 - a. Provide excavations conforming to dimensions and elevations indicated on the Drawings for each structure, including trenching for piping and all work incidental thereto.
 - b. After clearing is complete, excavate for the structure, down to the elevation indicated on the Drawings. Unless directed by ENGINEER, do not carry excavations below elevation indicated on the Drawings.
 - c. Where soil is encountered having unsuitable bearing value, ENGINEER may direct in writing that excavation be carried to elevations below those indicated on the Drawings.
 - d. Where excavations are made below elevations indicated on the Drawings, adjust elevations of excavations in accordance with the following requirements:
 - 1) Under slabs: Restore to proper elevation in accordance with procedure specified for backfill in this Section.
 - 2) Under footings: Restore to the proper elevation using one of the following:
 - a) Aggregate base course.
 - b) CLSM.
- e. Excavation width:
 - 1) Extend excavations at least 2 feet clear from walls and foundations of structures to allow for placing and removal of forms, installation of services, and inspection.
 - 2) Do not undercut slopes.
- f. Difficulty of excavation: No extra compensation will be made for removal of rock or any other material due to difficulty of excavation.
- 3. Excavation of lined channels:
 - a. Excavations in open cut for lined channels may be made so as to place concrete directly against excavated surfaces providing faces of excavations are:
 - 1) Firm and unyielding.
 - 2) Will stand or can be made to stand without sloughing.
 - b. Excavations to provide subgrade for lined channel or subdrainage material: Excavate to lines and grades indicated on the Drawings.
- 4. Excavation of unlined channels and basins:
 - a. Excavate to lines and grades indicated on the Drawings.
 - b. Perform excavation and grading so that finish surfaces are in uniform planes with no abrupt breaks in surface.
- 5. Excavation of ditches and gutters:
 - a. Cut ditches and gutters accurately to cross sections and grades indicated on the Drawings.

- b. Take care not to excavate ditches and gutters below grades indicated on the Drawings.
- c. Backfill excessive ditch and gutter excavations to grade with suitable material acceptable to ENGINEER that is thoroughly compacted.
- d. Do not deposit any material within 3 feet of edge of ditch unless otherwise indicated on the Drawings.
- 6. Necessary over excavation:
 - a. Where it becomes necessary to excavate beyond normal lines of excavation in order to remove boulders or other interfering objects, backfill voids remaining after removal as specified in backfilling of voids below, or as acceptable to the ENGINEER.
 - b. Backfill voids with material acceptable to the ENGINEER:
 - 1) With acceptance of the ENGINEER, backfill with one of the following:
 - a) Aggregate base course.
 - b) CLSM.

F. Materials for backfills, embankments, fills, roadway fills:

- 1. General:
 - a. Obtain import material from other sources if surplus materials from cuts and excavations obtained from within Project site do not conform to specified requirements or are not sufficient in quantity for construction of Project.
- 2. Backfills:
 - a. Backfill adjacent to structures, slabs, or walls: Native material or select material, or imported material meeting the requirements of select material unless otherwise specified or indicated on the Drawings.
 - b. Backfill material under concrete structures: Aggregate base course material, except in areas where controlled low-strength material or concrete encasement are indicated on the Drawings.
 - c. Extend backfill in any area under concrete structures from undisturbed soil or rock to the bottom aggregate base course material layer.
- 3. Embankments:
 - a. Native material, select material, or imported material meeting the requirements of native material or select material unless otherwise specified or indicated on the Drawings.
- 4. Fills:
 - a. Native material, select material, or imported material meeting the requirements of native material or select material unless otherwise specified or indicated on the Drawings.
 - b. Extend fill in any area under concrete structures from undisturbed soil or rock to the bottom aggregate base course material layer.
- 5. Roadway fills: One of the following, unless otherwise specified or indicated on the Drawings:
 - a. Aggregate base course material.
 - b. Native material, select material, or imported material meeting the requirements of native material or select material.

G. Placement:

- 1. General:
 - a. Lines and grades:
 - 1) Construct backfills, embankments, fills, and road fills, at locations and to lines and grades indicated on the Drawings.

- 2) Overbuild all permanent fill slopes by at least 1 foot and then cut to final grade to provide adequate compaction of the remaining fill.
2. Backfills:
 - a. Place loose material in successive layers that do not exceed 8 inches in depth after compaction.
 - b. Bring each layer to a moisture content between optimum moisture content and 3 percent above optimum moisture content before compacting.
 - c. Defective compacted backfills: Remove and recompact.
3. Fills:
 - a. Place loose material in successive layers that do not exceed 8 inches in depth after compaction.
 - b. Bring each layer to a moisture content between optimum moisture content and 3 percent above optimum moisture content before compacting.
 - c. Defective compacted fills: Remove and recompact.
4. Coarse fill:
 - a. When materials are coarsely graded so that performance of field density tests are impossible:
 - 1) Placement and compaction: Place material in lifts so as to obtain compacted thickness of 6 inches and roll with pneumatic roller or power roller.
 - 2) Moisture content: Provide moisture content of fraction of material passing 3/4 inch sieve within plus or minus 2.0 percent of optimum moisture as determined in accordance with ASTM D 1557, Method C.
5. Embankments:
 - a. Place loose material in successive layers that do not exceed 8 inches in depth after compaction.
 - b. Bring each layer to a moisture content between optimum moisture content and 3 percent above optimum moisture content before compacting.
 - c. Defective compacted embankments: Remove and recompact.
6. Roadway fills:
 - a. Place loose material in successive layers that do not exceed 8 inches in depth after compaction:
 - b. Bring each layer to a moisture content between optimum moisture content and 3 percent above optimum moisture content before compacting.
 - c. Defective compacted roadway fills: Remove and recompact.

3.04 FIELD QUALITY CONTROL

- A. Compliance Tests:
 1. Periodic compliance tests will be made by the CM to verify that compaction is meeting requirements previously specified. Cost of compliance tests will be paid by OWNER.
 2. Coordination with CM's Testing: Remove overburden above level at which the CM wishes to test and backfill and recompact excavation after testing is completed.
 3. If compaction fails to meet specified requirements, perform remedial work by one of the following methods:
 - a. Remove and replace backfill at proper density.
 - b. Bring density up to specified level by other means acceptable to the CM.

4. Retesting:
 - a. Costs of Retesting: Costs of retesting required to confirm and verify that remedial work has brought compaction within specified requirements shall be borne by the CONTRACTOR.

B. Tolerances:

1. Finish Grading of Excavations, Backfill and Fills:
 - a. Perform fine grading under concrete structures such that finished surfaces are never above established grade or approved cross section and are never more than 0.10 foot below.
 - b. Provide finish surface areas outside of structures that are not more than 0.10 foot above or below established grade or accepted cross section.
2. Excavation of Unlined Channels and Basins:
 - a. In Both Cut and Fill, and Levee and Access Road Side Slopes in Cut: Vertical tolerance of none above and 3 inches below specified grade will be allowed on bottom and side slopes.
 - b. On Top Surface of Levee and Access Road in Both Cut and Fill, and Levee and Access Road Side Slopes in Fill: Vertical tolerance of none below and 3 inches above specified grade will be allowed.
3. Areas Which Are Not under Structures, Concrete, Asphalt, Roads, Road Shoulders, Pavements, Walks, Dikes and Similar Type Items:
 - a. Provide finish-graded surfaces of either undisturbed natural soil, or cohesive material not less than 6 inches deep.
 - b. Intent of preceding is to avoid sandy or gravelly areas.
4. Finished Grading Surfaces:
 - a. Reasonably smooth, compacted, and free from irregular surface changes.
 - b. Provide degree of finish that is ordinarily obtainable from blade grader operations, except as otherwise specified.
 - c. Uniformly grade areas that are not under concrete.
 - d. Finish gutters and ditches so that they drain readily.

3.05 ADJUSTING

- A. Finish grades of excavations, backfills, and fills:
 1. Repair and reestablish grades to required elevations and slopes due to any settlement or erosion that may occur from action of the elements or any other cause prior to final acceptance.

3.06 PROTECTION

- A. Finish grades of backfills, cuts, excavations, and fills:
 1. Protect newly graded areas from erosion and deterioration by action of the elements.
- B. Ditches and gutters:
 1. Maintain ditches and gutters free from detrimental quantities of debris that might inhibit drainage until final acceptance.

END OF SECTION

SECTION 02303

HORIZONTAL DIRECTIONAL DRILLING

PART 1 GENERAL

1.01 SUMMARY

- A. The CONTRACTOR shall furnish all labor, equipment, and materials necessary to install a 24-inch inner-diameter pressure pipeline for the conveyance of treated effluent from the wastewater treatment plant. The pipeline will be installed within the limits shown on the plans, and within the tolerances described. A portion of the pipeline will be installed using horizontal directional drilling methods, or an approved alternate. The pressure pipeline material will be PVC or HDPE using approved materials and process to prevent corrosion as described elsewhere.
- B. Related Sections:
 - 1. Section 15052 - Basic Piping Materials and Methods.
 - 2. Section 15267 - High-Density Polyethylene Pipe.

1.02 REFERENCES

- A. Pressure Pipeline Design for Water and Wastewater, American Society for Civil Engineers, 2nd ed., 1992.
- B. Tables for Hydraulic Design of Pipes and Sewers, American Society for Civil Engineers, 5th ed., 1990.

1.03 DEFINITIONS

- A. A-1 - Back Reamer. A cutting head attached to the leading end of a drill string to enlarge the pilot bore diameter during a pullback operation and enable the product pipe to be installed.
- B. A-2 - Bent Sub. An offset section of drill stem located close behind the drill head that allows steering corrections to be made by positioning the cutting head. Frequently used in directional drilling in rock.
- C. A-3 - Bits. Replaceable cutting tools on the cutting head or drill string.
- D. A-4 - Carrier Pipe. The tube that carries the transported product. Typical pipe materials include steel, concrete, clay, plastic, ductile iron, and other materials.
- E. A-5 - Casing. A pipe to support a bore. Usually not a product pipe.
- F. A-6 - Cover or Overburden. The vertical depth from the top of the ground (top of pavement, top of ties, etc.), to the top of the casing or tunnel.
- G. A-7 - Crossing. Trenchless installation in which the primary purpose is to provide one or more passages beneath a surface obstruction.

- H. A-8 - Cutterhead/Cutting Head. Any tool or system of tools on a common support that excavates at the face of a bore. Usually applies to mechanical methods of excavation.
- I. A-9 - Directional Drilling. A steerable system for the installation of pipes, conduits, and cables in a shallow arc using a surface-launched drilling rig. Traditionally the term applies to large scale crossings in which a fluid filled pilot bore is drilled while rotating the drill string and then enlarged by a back reamer to the size required for the product pipe. The required deviation during pilot boring is provided by the positioning of a bent sub. Tracking of the drill string is achieved by the use of a downhole survey tool.
- J. A-10 - Drill Bit. A tool that cuts the ground at the head of a drill string, usually by mechanical means.
- K. A-11 - Drill String:
 - 1. The total length of drill rods/pipe, bit, swivel joint etc. in a drill borehole;
 - 2. System of rods used with cutting bit or compaction bit attached to the drive chuck.
- L. A-12 - Drilling Fluid/Mud. Typically, a mixture of water, bentonite, and/or polymer continuously pumped to the cutting head to facilitate the removal of cuttings, and stabilization of the borehole. In directional drilling, the fluid also cools the head and lubricates the installation of the product pipe. In suitable ground conditions, water alone may be used.
- M. A-13 - Entry/Exit Angle. In a horizontal directional drilling/guided boring system, the angle to the ground surface at which the drill string enters and exits in forming the pilot bore.
- N. A-14 - Expander. A tool which enlarges a bore during a pullback operation by compression of the surrounding ground rather than by excavation, sometimes used during a thrusting process as well as during pullback.
- O. A-15 - Fluid Assisted Boring/Drilling. A type of guided boring technique using a combination of mechanical drilling and pressurized fluid jets to provide the soil cutting action.
- P. A-16 - Grade. The elevations shown on plans and/or survey stakes for the installation of the carrier pipe. It is occasionally used to give elevations for casing. In most cases, it is given to the flow line but can also be given to the top of the pipe or casing.
- Q. A-17 - Ground Mat. Metal mats rolled out on either side of drill rack for operators and crew to stand on during operation to give grounding protection in case of electrical strike.
- R. A-18 - Ground Mat Cables. Cables connecting the drill rack to the ground mats.
- S. A-19 - Ground Rod. A copper/brass rod which is hand driven into the ground and is connected to the drill rack and mats to provide adequate grounding of unit and personnel.

- T. A-20 - Ground Rod Cable. Cable connecting the mats and drill rig to the ground rod.
- U. A-21 - Grout. A material such as a cement slurry, sand, or pea gravel that is pumped into voids.
- V. A-22 - Grouting. Filling of the annular space between the carrier pipe and the new product pipe. Grouting is also used to fill the space around laterals and between the new pipe and manholes. Other uses of grouting are for localized repairs of defective pipes and ground improvement prior to excavation during new installations.
- W. A-23 - Guided Boring. A steerable system for the installation of pipes, conduits, and cables using a drilling rig. A pilot bore is drilled using a rotating drill string and is then enlarged by a back reamer to the size required for the product pipe. The necessary deviation during pilot boring is provided by a slanted face to the drill head, an asymmetric drill head, eccentric fluid jets, or a combination of these usually in conjunction with a locator.
- X. A-24 - Launch Pit. As for drive pit but more usually associated with "launching" a trenchless technology excavation tool.
- Y. A-25 - Line. (1) The specified direction of the proposed bore in a horizontal plane; (2) (Path) The distance between two points as laid out by a survey crew for the installation of pipelines and their bores and tunnels.
- Z. A-26 - Lining. An internal, non-structural coating or lining material applied to a pipe.
- AA. A-27 - Locator. An electronic instrument used to determine the position and strength of electro-magnetic signals emitted from a transmitter sonde in the pilot head of a boring system, in an impact moling tool, or from existing services that have been energized. Sometimes referred to as a walkover system.
- BB. A-28 - Marsh Funnel. An instrument used to determine viscosity. For trenchless applications, used to determine slurry viscosity. The Marsh funnel test is performed by pouring a slurry sample through a screen at the top of the funnel to trap large particulates. After the funnel is filled, the bottom of the funnel is opened and the slurry is allowed to flow. The flow rate is calculated as the number of seconds required for a quart of slurry to drain out of the funnel.
- CC. A-29 - Measurement While Drilling (MWD). Borehole survey instrumentation that provides continuous information simultaneously with drilling operations, usually transmitting to a display at or near the drilling rig.
- DD. A-30 - Mixed Face. A soil condition that presents two or more different types of material in the cross-section of the bore.
- EE. A-31 - Muck. As a noun, it means the same as spoil. As a verb, it means to dig as in "muck out the hole."
- FF. A-32 - Open Cut. Excavation to the required underground level for the installation, maintenance, or inspection of a pipe, conduit, or cable. The excavation is then backfilled and the surface restored.

- GG. A-33 - Ovality. The difference between the maximum diameter divided by the mean diameter at any one cross section of a pipe, generally expressed as a percentage.
- HH. A-34 - Pilot Bore. The action of creating the first (usually steerable) pass of any boring process that later requires back reaming or similar enlarging. Most commonly applied to guided boring and directional drilling.
- II. A-35 - Product Pipe. Permanent pipeline for operational use.
- JJ. A-36 - Pullback. That part of a guided boring, mini-HDD, or horizontal directional drilling process in which the drill string is pulled back through the bore to the entry pit, usually installing a product pipe at the same time.
- KK. A-37 - Pullback Force. The tensile load applied to a drill string during the pull-back process. Guided boring and directional drilling rigs are generally rated by their maximum pull-back force.
- LL. A-38 - Reinstatement/Restoration. The backfilling, compaction and re-surfacing of any excavation to restore the surface and underlying structure to enable it to perform its original function.
- MM. A-39 - Roller Cone Bit or Reamer. A bit or reamer in which the teeth rotate on separate, internal shafts that are usually aligned perpendicular to line; used for boring rock.
- NN. A-40 - Sonde Housing. Integral unit in the directional drill head which also houses the sonde radio sending unit.
- OO. A-41 - Spiral Weld Pipe (Casing). Pipe made from coils of steel plate by wrapping around a mandral in such a manner that the welds are a spiral helix.
- PP. A-42 - Spoil (Muck). Earth, rock and other materials displaced by a tunnel or casing, and removed as the tunnel or casing is installed.
- QQ. A-43 - Stakedown Plate. A plate staked to the ground to stabilize the forward end of the drill rack.
- RR. A-44 - Sub saver. A replaceable sub on the carriage motor to which the drill pipe is connected.
- SS. A-45 - Survey Tools. Downhole equipment and instruments used to determine the position of a bore in directional drilling or site investigation.
- TT. A-46 - Swageing. The reduction in diameter of a polyethylene pipe by passing it through one or more dies. The die may be heated if necessary.
- UU. A-47 - Swivel Pulling. Used to attach service (to be pulled into drilled hole) to drill pipe.
- VV. A-48 - Trenchless Technology. Refers to a family of methods, materials, and equipment that can be used for installation of new or replacement or rehabilitation of existing underground infrastructure with minimal disruption to surface traffic,

business, and other activities, as opposed to open trenching and its associated major disruptions to surface activities.

WW.A-49 - Walkover System. See Locator.

XX. A-50 - Washover Pipe. A rotating drill pipe of larger diameter than the pilot drill pipe and placed around it with its leading edge less advanced. Its purpose is to provide stiffness to the drilling pipe in order to maintain steering control over long bores, to reduce friction between the drill string and the soil and to facilitate mud circulation. See directional drilling.

YY. A-51 - Water Table. The elevation of the ground water.

ZZ. A-52 - Wrapped Casing (Wrapped Pipe). A coating on pipe for protection from corrosion, usually composed of asphalt and asphalt coated paper. Some coatings may contain plastic, fiberglass, coal tar, or other materials.

1.04 QUALITY ASSURANCE

A. Qualifications for HDD Subcontractors will be added.

B. Daily Logs and Records. Daily logs and records will be maintained by the CONTRACTOR and will document the following: drilling lengths, location of drill head, drilling fluid pressures and flow rates, drilling fluid losses, inadvertent returns, drilling times required for each pipe joint, any instances of retraction and redrilling of the pilot bore or segments thereof, and any other relevant observations. The drilling fluid pressures will be measured at the entry point, at the injection nozzle, and within the annular space 1 to 2 feet behind the drill head. Piezometric pressures will be monitored continuously at the 2 piezometer locations shown on the Drawings during drilling operations. The piezometer readings will be provided in the daily reports along with plots of piezometric pressures verses time and position of drill head. These records will be maintained and updated daily, or more frequently, as directed by the CM. The position of the drill head will be continuously tracked and recorded. A plot of actual and planned locations of the bore path will be maintained and updated daily, or more frequently, as directed by the CM. Quality control measurements of steel pipe dimensions will be made by the CONTRACTOR and checked against allowable tolerances for each pipe section used. Any pipe sections not meeting specified tolerances will be replaced or repaired to the CM's satisfaction at no additional cost to the OWNER.

C. Advance Notice and Inspections. The CONTRACTOR will provide at least 72 hours advance written notice (not including holidays or weekends) to the CM of the planned inception of major drilling activities, including pilot hole launch, prereaming, reaming, and pipe pullback. The CONTRACTOR will immediately notify the CM, in writing, when any significant problems are encountered or if ground conditions are construed by the CONTRACTOR as being materially and significantly different than the conditions presented in the geotechnical investigation report. All work by the CONTRACTOR will be performed in the presence of the CM, unless CM grants prior written approval to perform such work in CM's absence.

D. Surveying Equipment and Procedures. All surveying equipment used for downhole surveying and tracking of the borepath and drill head will be inspected and calibrated prior to use.

- E. Pipe. The pipe will be certified by the CONTRACTOR as meeting all requirements of the specifications. The fabricated pipe will be pressure-tested by the CONTRACTOR prior to pullback and after installation is completed.
- F. Equipment. The CONTRACTOR shall provide written certification by the manufacturer that the drilling equipment is capable of completing the planned installation.

1.05 SAFETY

- A. It shall be the CONTRACTOR's sole responsibility to see that the work is done in conformance with all applicable federal, state, and local safety requirements. Required safety equipment and procedures shall be employed by the CONTRACTOR at all times. During drilling operations, all equipment shall be effectively grounded, and shall incorporate an audible alarm warning system that warns workers of electrical hazards. The system shall be capable of sensing contact with an energized electrical cable. The system shall be checked by the CONTRACTOR to verify proper operation prior to initiation of drilling operations. All equipment will be connected to a ground with a copper conductor capable of handling maximum anticipated fault current as determined by the CONTRACTOR. Crew members handling drill stems and operating drilling equipment will wear hot boots and hot gloves, safety glasses, and hard hats. Crew members will stand on grounded wire mesh mats. The locator operator will wear hot boots.

1.06 SUBMITTALS

- A. The following are required for submittal by the CONTRACTOR to the CM who shall provide written notice of acceptance before work will be allowed to commence. Review of submittals by the CM does not constitute approval nor relieve the CONTRACTOR of any responsibilities to exercise care and diligence in the planning and execution of the work.
- B. Quality Assurance and Qualifications. The CONTRACTOR shall submit qualifications of key personnel, assigned to the project upon award. The CONTRACTOR shall submit examples of the daily logs and records that will be maintained. The actual daily logs and records will be provided to the CM within 1 working day of the date to which the records pertain. The CONTRACTOR will provide at least 72 hours written notice of the planned inception of drilling activities as described in Article 1.04 Paragraph C.
- C. Shop Drawings. The CONTRACTOR shall submit all shop drawings to the CM. All shop drawings shall have been reviewed and accepted by the CM prior to CONTRACTOR's mobilization. The shop drawings will be neat and legible, with all dimensions and notes shown in English. The drawings will include the planned equipment, equipment setup areas, pipe layout areas, any excavations, mud containers (this is an environmentally sensitive area - maintaining mud in container structure is preferred), and any anticipated or proposed deviations from the design plan and profile views of the pipeline. Fax copies will not be acceptable.

- D. Schedule:
1. At least 15 days prior to mobilization, the CONTRACTOR shall submit a detailed schedule with all major construction activities and durations, with beginning and completion dates shown. The schedule shall include:
 - a. Rig mobilization and setup.
 - b. Pilot hole drilling.
 - c. Prereaming.
 - d. Reaming and pullback of pipe.
 - e. Cleanup and restoration.
 2. This schedule shall be updated weekly, or more frequently as directed by the CM.
- E. Description of Methods, Equipment, and Materials. The CONTRACTOR shall submit detailed descriptions of methods, equipment, and materials planned to be used for the pipeline installation. Descriptions of materials will be accompanied by Materials Safety Data Sheets (MSDS) and manufacturers' descriptions and warranties. Descriptions of equipment will include manufacturers' specifications, calibrations, appropriate drawings, photographs, and descriptions of any modifications since manufacture. All drawings and photos must be originals or clear photocopies with legible dimensions in US Customary Units. Faxed copies will not be acceptable.
- F. Downhole Pressure Sensing Device. The CONTRACTOR shall submit manufacturer's documentation on the calibration and operation of pressure sensing devices planned for measuring drilling fluid pressures in the annulus, as required in Article 3.04 Paragraph E.3.
- G. Drilling Fluid Pressures. The CONTRACTOR shall submit calculations detailing the maximum and minimum allowable drilling fluid pressures expected during the directional drilling process. These calculations shall address minimum pressures required for borehole stabilization as well as maximum allowable pressures to prevent inadvertent drilling fluid returns. The calculations shall be made and stamped by a California Professional Engineer.
- H. Surveying Equipment and Procedures. The CONTRACTOR shall submit records of equipment calibrations and certifications for all equipment used for downhole surveys and tracking of the drill head and bore path. Procedures to be used shall be described in the submittal, including quality assurance measures.
- I. Calculations for Thrust, Torque, and Pullback. The CONTRACTOR shall submit calculations for thrust, torque, and pullback loads, for the conditions and operating practices anticipated.
- J. Pipe Stress Calculations. The CONTRACTOR shall submit calculations for drill stem and pipe stresses expected to result from the thrust, torque, pullback, bending, earth loads, groundwater loads, and any other installation and service loads expected to be exerted on the drill stem and pipe. The allowable axial, bending, and torsional stresses will be submitted. All assumptions used for calculation purposes, including the radius of curvature and temperature will be provided. These calculations will be made and stamped by a professional engineer licensed in the state of California. The pipe thickness must conform to the most conservative

design with respect to design calculations for internal pressure and pullback forces, with a minimum safety factor of 2.0.

- K. Radius of Curvature. The CONTRACTOR shall submit the radius of curvature planned for the installation of the pipeline along with calculations showing that installation stresses do not exceed allowable stresses. A minimum safety factor of 2.0 will be used in the determination of allowable stress.
- L. Plans for Disposal of Spoils and Drilling Fluids. The CONTRACTOR shall submit plans for disposal of waste materials resulting from the pipeline construction, including drilling fluids, cuttings, waste oil, fuel, discharge water, etc. The CONTRACTOR shall identify the disposal site and procure and submit a letter from the licensed disposal site indicating willingness and legal authority to accept the described waste products.
- M. Safety Plan. The CONTRACTOR will submit the Safety Plan, including the name of the CONTRACTOR's Site Safety Representative, emergency telephone numbers for medical facilities, and precautions for handling and disposal of any hazardous or flammable materials.
- N. Contingency Plans for Potential Problems. The CONTRACTOR shall submit contingency plans for remediation of potential problems that may be encountered during the drilling operations. The contingency plans will address the observations that would lead to the discovery of the problem, the methods that would be used to mitigate the problem, and estimated time and cost to mitigate the problem and resume the installation. Potential problems that shall be addressed include:
 - 1. Obstructions encountered.
 - 2. Drilling fluid pressures exceed maximum allowable pressures.
 - 3. Inadvertent drilling fluid returns (hydro-fracture).
 - 4. Loss of circulation.
 - 5. Deviation from planned borepath.
 - 6. Inability to advance drill stem or pipe.
 - 7. Drill stem or pipe stresses exceed allowable values for torsion, bending, axial tension, or compression.
 - 8. Drill stem or pipe twisted off or broken off in borehole.
 - 9. Pipe collapse.
- O. The following shall be submitted as construction progresses and at the completion of construction.
 - 1. Daily Logs and Records. The CONTRACTOR shall submit complete, legible, written daily logs and records as called for in Article 1.04 Paragraph B and as directed by the CM, within 1 working day of the date to which the records correspond.
 - 2. Welding Records. The CONTRACTOR shall submit complete records of inspections for 100 percent of all welds at all pipe joints. Any repairs to welds will be documented and re-inspected, and the records of repairs and re-inspections submitted. The name and qualifications of the welder and welding inspector will also be submitted.
 - 3. Pressure Test Records. The CONTRACTOR shall submit all pressure test records for both the pre-installation and post-installation tests.

4. Variations in Plan and Profile. Any variations between actual and design plan and profile locations of the bore path will be documented by the CONTRACTOR and submitted to the CM immediately upon discovery.
5. As-Built Drawings. The CONTRACTOR shall submit as-built drawings showing plan and profile views of the installed pipeline, correctly referenced to benchmarks, and major site features.
6. Mud Weights. The CONTRACTOR shall submit calculations on expected mud and/or drilling fluid weights for stabilization of the bore hole.

PART 2 PRODUCTS

2.01 GENERAL

- A. The CONTRACTOR shall furnish all equipment and materials for completing the installation. The products and materials to be used shall meet the specifications listed below and in related sections cited.

2.02 HDPE PIPE

- A. HDPE pipe per Section 15267.

2.03 DRILLING FLUIDS

- A. The CONTRACTOR will provide MSDS for all drilling fluids planned for use or on site. Drilling fluids shall be a mixture of water and bentonite, with mixture proportions selected by the CONTRACTOR to ensure borehole stability, reduce drag on the pipe, and completely fill the annular space between the bore and the pipe to control settlement. Management and disposal of drilling fluids shall be the CONTRACTOR's responsibility.

2.04 DRILL RODS/DRILL STEM

- A. The CONTRACTOR will provide high quality drill rods that the CONTRACTOR has inspected and determined are adequate for the project requirements. Bent, cracked, or fatigued drill stem will not be used. Threads must be in good condition. The lengths of drill rods should be measured and recorded.

2.05 CONNECTIONS

- A. Manholes and connections are shown on Drawings.

PART 3 EXECUTION

3.01 GENERAL

- A. Inspection of Conditions. The CONTRACTOR shall inspect the site prior to initiating work to be satisfied of the general conditions and requirements of the work to be performed. The CONTRACTOR shall not proceed until any and all unsatisfactory conditions have been corrected.

- B. Preparation:
1. CONTRACTOR shall adequately protect existing structures and utilities before and during construction.
 2. CONTRACTOR shall not initiate directional drilling until all submittals are received, reviewed, and accepted.
 3. CONTRACTOR shall not initiate directional drilling until all permits and easements are obtained.
- C. Work Hours. The CONTRACTOR's work shall be performed during normal daylight hours, to the extent practical. Work hours may be extended for the pipe pullback, if requested in writing by the CONTRACTOR and accepted by the CM. If night work is performed, the CONTRACTOR shall provide adequate temporary lighting to ensure safe conditions and allow inspection.

3.02 CONSTRUCTION AREA

- A. The CONTRACTOR shall limit his operations to the areas shown on the plans, or as otherwise accepted in writing by the CM, for storage of equipment and materials, parking, and actual pipe layout, drilling, and other work.
- B. The CONTRACTOR shall maintain the work area in a manner that will minimize adverse impacts on traffic, business, and other public use activities. The CONTRACTOR shall proceed with work in a safe, orderly manner, while maintaining the work site free of debris and unnecessary equipment and materials. The CONTRACTOR shall take all measures necessary to minimize and control drilling fluid spillage or returns at entry and exit points, and at intermediate points, by controlling operating pressures, drilling speed, and other operational factors. All inadvertent returns or spills shall be promptly cleaned up. Mobile spoil removal equipment will be on site during all drilling, prereaming, reaming, and pullback operations and shall be capable of quickly removing spoils. The CONTRACTOR shall immediately notify CM of any inadvertent returns or spills and immediately clean up the return or spill.
- C. The CONTRACTOR's procedures and equipment shall provide protection of workers, particularly against electrical shocks. As a minimum, grounding mats, grounded equipment, hot boots, hot gloves, safety glasses, and hard hats will be used at all times. The equipment will have an alarm system capable of detecting contact of the drilling equipment with electrical current.

3.03 DIRECTIONAL DRILLING

- A. The CONTRACTOR shall provide all equipment, materials, and personnel necessary for completing the installation as shown on the Drawings. The equipment and materials shall include:
1. Directional drilling rig with all necessary ancillary equipment, including drill stem, cutting bits, reaming bits, swivels, expanders, motors, pumps, hoses, mixing equipment, drilling fluid processing equipment (cuttings separation equipment), downhole survey equipment, fluid pressure and flowrate monitoring equipment, spare parts, pipe handling equipment, crane, backhoe, roller, sideboom tractors, control cabin and control equipment, and office equipment.

2. Drilling fluids, water, fuel, lubricant, polymers, or other additives.
 3. Any other expendable or reusable materials, supplies, and equipment needed for the installation.
- B. Entry and Exit Angles. Drill entrance and exit angles shall approximately 10 and 8 percent, respectively, unless otherwise approved in writing by the ENGINEER.
- C. Pilot Hole. The pilot hole shall follow the design path of the bore shown on the drawings.
1. Horizontal and Vertical Tolerances. Horizontal and vertical deviations shall be less than plus or minus 3 feet from the design path centerline unless otherwise approved. Horizontal and vertical position will be continuously monitored and recorded at least twice per drill stem length, or at 15 feet or 15-minute intervals, whichever is most frequent.
 2. Radius of Curvature. The radius of curvature shall not be less than that shown on the drawings nor the calculated minimum value to maintain pipe stresses within allowable limits. The radius of curvature shall be calculated over the distance of 3 drill stem sections. At no point along the alignment should the radius of curvature be less than 600 feet, unless approved in writing by the ENGINEER.
 3. Entry and Exit Tolerances. The location of the entry shall be within a 2-foot circular area centered on the entry point coordinates shown in the drawings and verified by the CONTRACTOR's survey. The exit point shall be within a 3-foot wide by 10-foot long rectangle centered over the exit point coordinates shown on the plans and verified by the CONTRACTOR's survey.
- D. Drill Rig Capacity. The capacity of the directional drilling system used by the CONTRACTOR shall be adequate to install the specified pipeline. The system should have thrust, pullback, and torque capacities at least double, i.e., 100 percent greater than the required values of thrust, pullback, and torque calculated and submitted by the CONTRACTOR as necessary for the installation. The CONTRACTOR shall submit these calculations and supplemental records from similar projects to verify the reasonableness of the calculations. Similar projects will be deemed those with diameters, depths, installed lengths, and ground conditions similar to those of the specified project. Project owner, point of contact, and telephone number and address shall be submitted for such projects.
- E. Instrumentation and Monitoring. The CONTRACTOR shall at all times provide and maintain in good working order an instrumentation and monitoring system that is capable of accurately locating the position of the drill head in the x, y, and z axes, that is capable of monitoring and recording drilling fluid pressures and flow rates, and drill stem thrust, torque, and pullback loads. These data shall be recorded at least twice per drill pipe length or every 15 feet or 15 minutes, whichever is most frequent. These data shall be submitted to the CM within one working day of the date to which the records pertain.
1. Position of drill head. CONTRACTOR shall monitor and record x, y, and z coordinates relative to an established surface survey bench mark, from downhole survey data and surface survey data, using the Tru Tracker or equivalent surface survey system. The data shall be recorded at least twice per drill stem length or at 15 feet or 15-minute intervals during drilling, whichever is most frequent. Deviations between the recorded and design bore path will be calculated and reported on the daily log. If the deviations exceed

tolerances specified elsewhere, such occurrences will be reported immediately to the CM.

2. Drill Stem Thrust and Torque. Drill stem thrust and torque will be measured and recorded at least twice per drill stem length or at 15 feet or 15-minute intervals, whichever is most frequent. Sudden increases in torque or thrust will be reported to the CM immediately. All measurements will be made during pilot hole drilling, prereaming, reaming, and pullback, and will be submitted with daily logs. Instances of thrust, torque, or pullback exceeding allowable limits will be reported immediately to the CM.
 3. Drilling Fluid Pressures and Flow Rates. Drilling fluid pressures and flow rates will be continuously monitored and recorded by the CONTRACTOR. The pressures will be monitored at the entry point, at the injection nozzle, and at two locations within 2 feet behind the drill head in the annular space between the drill stem and bore or between the pipe and bore. These measurements will be made during pilot hole drilling, and during reaming and pullback operations.
 4. Drilling Fluid Viscosity and Density. The CONTRACTOR will measure and record drilling fluid viscosity and density at least 3 times per shift with at least 2 hours between readings, using calibrated Marsh funnel and mud balance. These measurements will be included in daily logs submitted to the CM. The CONTRACTOR will document modifications to the drilling fluids, by noting the types and quantities of drilling fluid additives and the dates and times when introduced. The reason for the addition of drilling fluid additives or other modifications will be documented and reported.
 5. Obstructions. The CONTRACTOR shall notify the CM immediately in the event that any obstruction is encountered that prevents further advancement of the drill stem, or pullback of the prereamer, reamer, and/or pipe. The CONTRACTOR, CM, and ENGINEER shall investigate the cause and together determine an appropriate response. Appropriate response may include revisions to equipment or methods, retraction and redrilling of a portion of the bore, or abandonment of the hole. If abandonment is deemed necessary, the CONTRACTOR shall recover, to the extent practically possible, any drill stem, pipe, and tools in the bore, and properly abandon the bore, unless otherwise directed in writing by the ENGINEER. If the bore is abandoned, the CONTRACTOR shall pressure-grout the abandoned bore with a lean cement-sand grout mixture, or other approved materials. If the bore is abandoned, the CONTRACTOR shall be allowed to begin a second attempt to install the pipeline at an alternate location approved in writing by the ENGINEER. In any case, the CONTRACTOR shall take all reasonable actions to complete the installation with minimal delays. The extra costs and payments to the CONTRACTOR, if any, will be negotiated between the OWNER and CONTRACTOR, based on the cause and reasonable time and materials. For purposes of this contract, an obstruction is defined as any hard object lying completely or partially within the design pathway of the bore and pipeline, that prevents further advancement of the drill stem, prereamer, reamer, and/or pipe.
- F. Prereaming. The pilot bore shall be prereamed, using equipment and methods submitted by the CONTRACTOR. The prereaming operations shall be accomplished in two passes, unless otherwise approved in advance in writing by the ENGINEER, with the first prereaming operation conducted with a fly cutter or similar device selected by the CONTRACTOR of 30-inch diameter or less. The

second prereaming operation will be conducted with a fly cutter and barrel expander combination or other apparatus with a diameter 12 inches larger than the project pipe outside diameter, or other size and type, selected by the CONTRACTOR if approved in writing by the ENGINEER. All measurements called for during the pilot boring operation shall also be made and recorded during the prereaming operations, and submitted on the daily logs.

- G. Pipeline Fabrication. The CONTRACTOR shall fabricate and test the pipeline, prior to installation in the prepared bore path. CONTRACTOR shall provide all necessary labor, equipment, and materials to fabricate and test the pipeline. The length of fabricated pipeline shall extend beyond the entry and exit locations sufficient distance to allow connections to adjacent pipe sections. The pipe layout and fabrication area shall be within the areas specified on the Drawings, unless otherwise approved in writing by the ENGINEER.
1. The CONTRACTOR shall use a temporary pipe storage area as needed to protect the pipe prior to installation. The CONTRACTOR shall provide all necessary protective padding materials and skids to protect the pipe and coatings or linings, during storage, fabrication, and installation.
 2. The CONTRACTOR shall provide adequate supports and rollers along the pipe layout area to support the pipe during installation and to protect the pipe and coatings or linings from damage by stones, debris, etc., on the ground.
 3. Welding. The CONTRACTOR shall clean all surfaces to be welded of any material that could adversely impact weld quality and performance. The pipe shall be positioned and aligned to provide favorable conditions for the welding operations. The favorable alignment and position shall be maintained during deposition of the weld. The steel pipe sections shall be welded using an approved butt welding process. The welds shall result in a fully watertight section, when tested at 150 percent of the design internal pressures, and shall attain a strength equal or greater than the pipe strength. The CONTRACTOR shall perform inspection of 100 percent of all welds. Welds that fail to meet specified requirements will be repaired at no expense to the OWNER by grinding or other approved process. Removal by cutting torch of defective welds will not be permitted, unless approved in writing by the ENGINEER. All weld inspections, repairs, and re-inspection records shall be submitted to the CM.
 4. Hydrostatic Pretest. The CONTRACTOR shall perform hydrostatic pretest after welding and before installation. The OWNER will provide potable water for this test. Test pressures will be monitored, along with temperature, with calibrated, inspected devices during this test. Tests will be conducted as specified in Section 15052.
- H. Pipe Pullback. The pipe shall be installed by pulling it into the prereamed bore path in a continuous operation, behind a final reaming tool that is 12 inches larger in diameter than the project pipe outside diameter, or other size selected by the CONTRACTOR if accepted in writing by the ENGINEER. The pipe shall be isolated from excessive torsional and axial stresses by a swivel device with a pre-established breakaway tensile capacity that is lower than the allowable tensile stress of the pipe. All measurements called for during pilot hole and prereaming shall be made, recorded, and submitted on the daily logs during final reaming and pipe pullback. The CONTRACTOR shall monitor and inspect pipe rollers and sideboom equipment if used to avoid damage to the pipe. CONTRACTOR shall

cease operations if the pipe or linings or coatings are damaged and shall repair, using an approved process and materials, before resuming installation.

- I. Final Hydrostatic Test. The CONTRACTOR shall conduct a final hydrostatic test of the installed pipeline. The test pressure will be maintained with no loss of pressure for at least 2 hours. Pressure and temperature readings will be taken at not greater than 15-minute intervals during the final hydrostatic test, using approved instruments. The CONTRACTOR will repair any defects discovered during this test, and repeat the test until the test pressure can be maintained for at least 2 hours without loss of pressure.
- J. Site Restoration and Demobilization. The CONTRACTOR shall remove all equipment, materials, and waste or debris from the site and restore site to its original condition upon completion of the installation. Restoration and demobilization shall be completed by the CONTRACTOR within 7 days of the completion of the pipeline installation.
- K. Groundwater Monitoring. Piezometers will be installed by the CONTRACTOR at locations approved by ENGINEER to monitor changes in groundwater pressure that may result from directional drilling operations. The piezometers may be an open standpipe or pneumatic device with a filter or screen on the bottom 5 feet interval. The bottom of the screened interval of the piezometers will be located 5 feet above the crown of the bore and the piezometers will be located along or within 5 feet of the centerline of the bore in plan view. Standpipe piezometers shall be properly installed, following the manufacturers' written recommendations, and backfilled with sand surrounding the screened interval and a bentonite seal above the screened interval. Alternatively, pneumatic piezometers may be installed and calibrated using manufacturer's written procedures.
- L. The piezometers will be installed at least one month prior to mobilization of the directional drilling equipment. Prior to mobilization of the directional drilling equipment, the CONTRACTOR will read the piezometers at least once per week, or more frequently as directed by the ENGINEER, to establish a baseline for groundwater pressures. All readings will be recorded and submitted to the CM on a weekly basis. Any suspect readings or problems with the instruments should be noted and reported by the contractor. Instruments that do not function properly, in the opinion of the ENGINEER, will be replaced by the CONTRACTOR at no additional cost to the OWNER, as soon as the unsatisfactory performance is noted. In no case will mobilization or directional drilling activities begin before all piezometers are installed and functioning properly.
- M. During directional drilling operations, the piezometers will be read at least once per drill stem length, or each half-hour, whichever is more frequent. The reading interval may be modified by the ENGINEER. All readings will be submitted to the CM on a daily basis during directional drilling activities.

END OF SECTION

SECTION 02312

CONTROLLED LOW-STRENGTH MATERIAL (CLSM)

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes: Controlled low-strength material (CLSM).
- B. Related sections:
 - 1. The Contract Documents are complementary; what is called for by one is as binding as if called for by all.
 - 2. It is the CONTRACTOR's responsibility for scheduling and coordinating the Work of subcontractors, suppliers, and other individuals or entities performing or furnishing any of CONTRACTOR's Work.
 - 3. The following Sections are related to the Work described in this Section. This list of Related Sections is provided for convenience only and is not intended to excuse or otherwise diminish the duty of the CONTRACTOR to see that the completed Work complies accurately with the Contract Documents.
 - a. Section 03200 – Concrete and Reinforcement.

1.02 REFERENCES

- A. ASTM International (ASTM):
 - 1. C 31 - Standard Practice for Making and Curing Concrete Test Specimens in the Field.
 - 2. C 33 - Standard Specification for Concrete Aggregates.
 - 3. C 39 - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
 - 4. C 143 - Standard Test Method for Slump of Hydraulic Cement Concrete.
 - 5. C 231 - Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.
 - 6. C 260 - Standard Specification for Air-Entraining Admixtures for Concrete.
 - 7. C 618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.
 - 8. D 1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³(2,700 kN-m/m³)).

1.03 SYSTEM DESCRIPTION

- A. Performance requirements:
 - 1. Total calculated air content: Not be less than 8.0 percent nor greater than 12.0 percent.
 - 2. Minimum unconfined compressive strength: Not less than 50 pounds per square inch measured at 28 days.
 - 3. Maximum unconfined compressive strength: Not greater than 150 pounds per square inch measured at 28 days.
 - 4. Wet density: No greater than 132 pounds per cubic foot.

1.04 SUBMITTALS

- A. Product data: Submit data completely describing products.
- B. Sieve analysis: Submit sieve analyses of fine and coarse aggregates being used in triplicate. Resubmit at any time there is a significant change in grading of materials.
- C. Mix: Submit full details, including mix design calculations for mix proposed for use.
- D. Trial batch test data:
 - 1. Submit data for each test cylinder.
 - 2. Submit data that identifies mix and slump for each test cylinder.
- E. Cement mill tests: Include alkali content, representative of each shipment of cement for verification of compliance with specified requirements.
- F. Pozzolan certificate of compliance: Identify source of pozzolan and certify compliance with requirements of ASTM C 618.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Portland cement: Type II low alkali portland cement as specified in Section 03200.
- B. Fly ash: Class F fly ash in accordance with ASTM C 618.
- C. Water: As specified in Section 03200.
- D. Admixture: Air entraining admixture in accordance with ASTM C 260.
- E. Fine aggregate: Concrete sand that does not need to be in accordance with ASTM C 33. No more than 12 percent of fine aggregate shall pass a No. 200 sieve, and no plastic fines shall be present.
- F. Coarse aggregate: Pea gravel no larger than 3/8 inch.

2.02 SOURCE QUALITY CONTROL

- A. Trial batch:
 - 1. After mix design has been accepted by ENGINEER, have trial batch of the accepted mix design prepared by testing laboratory acceptable to ENGINEER.
 - 2. Prepare trial batches using specified cementitious materials and aggregates proposed to be used for the Work.
 - 3. Prepare trial batch with sufficient quantity to determine slump, workability, consistency, and to provide sufficient test cylinders.
- B. Test cylinders:
 - 1. Prepare test cylinders in accordance with ASTM C 31 with the following exceptions:
 - a. Fill the concrete test cylinders to overflowing and tap sides lightly to settle the mix.

- b. Do not rod the concrete mix.
 - c. Strike off the excess material.
 - 2. Place test cylinders in a moist curing room. Exercise caution in moving and transporting the cylinders since they are fragile and will withstand only minimal bumping, banging, or jolting without damage.
 - 3. Do not remove the test cylinder from mold until the cylinder is to be capped and tested.
 - 4. The test cylinders may be capped with standard sulfur compound or neoprene pads:
 - a. Perform the capping carefully to prevent premature fractures.
 - b. Use neoprene pads a minimum of 1/2 inch thick, and 1/2 inch larger in diameter than the test cylinders.
 - c. Do not perform initial compression test until the cylinders reach a minimum age of 3 days.
- C. Compression test 8 test cylinders: Test 4 test cylinders at 3 days and 4 at 28 days in accordance with ASTM C 39 except as modified herein:
 - 1. The compression strength of the 4 test cylinders tested at 28 days shall be equal to or greater than the minimum required compression strength, but shall not exceed maximum compression strength.
- D. If the trial batch tests do not meet the Specifications for strength or density, revise and resubmit the mix design, and prepare additional trial batch and tests. Repeat until an acceptable trial batch is produced that meets the Specifications.
 - 1. All the trial batches and acceptability of materials shall be paid by the CONTRACTOR.
 - 2. After acceptance, do not change the mix design without submitting a new mix design, trial batches, and test information.
- E. Determine slump in accordance with ASTM C 143 with the following exceptions:
 - 1. Do not rod the concrete material.
 - 2. Place material in slump cone in one semi-continuous filling operation, slightly overfill, tap lightly, strike off, and then measure and record slump.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Prior to placement, soils located below controlled low strength material placement shall be scarified to a depth of 8 inches, uniform moisture conditioned to or above the optimum moisture content, and compacted to a minimum of 95 percent relative compaction in accordance with ASTM D 1557.
- B. Place controlled low strength material by any method which preserves the quality of the material in terms of compressive strength and density:
 - 1. Limit lift heights of CLSM placed against structures and other facilities that could be damaged due to the pressure from the CLSM, to the lesser of 3 feet or the lift height indicated on the Drawings. Do not place another lift of CLSM until the last lift of CLSM has set and gained sufficient strength to prevent lateral load due to the weight of the next lift of CLSM.
 - 2. The basic requirement for placement equipment and placement methods is the maintenance of its fluid properties.

3. Transport and place material so that it flows easily around, beneath, or through walls, pipes, conduits, or other structures.
4. Use a slump of the placed material greater than 9 inches, and sufficient to allow the material to flow freely during placement:
 - a. After trial batch testing and acceptance, maintain slump developed during testing during construction at all times within plus or minus 1 inch.
5. Use a slump, consistency, workability, flow characteristics, and pumpability (where required) such that when placed, the material is self-compacting, self-densifying, and has sufficient plasticity that compaction or mechanical vibration is not required.

3.02 FIELD QUALITY CONTROL

A. General:

1. Make provisions for and furnish all material for the test specimens, and provide manual assistance to assist the ENGINEER in preparing said specimens.
2. Be responsible for the care of and providing curing condition for the test specimens.

B. Tests by CM:

1. During the progress of construction, the OWNER will have tests made to determine whether the controlled low strength material, as being produced, complies with the requirements specified hereinbefore. Test cylinders will be made and delivered to the laboratory by the CM and the testing expense will be borne by the OWNER.
2. Test cylinders:
 - a. Prepare test cylinders in accordance with ASTM C 31 with the following exceptions:
 - 1) Fill the concrete test cylinders to overflowing and tap sides lightly to settle the mix.
 - 2) Do not rod the concrete mix.
 - 3) Strike off the excess material.
 - b. Place the cylinders in a safe location away from the construction activities. Keep the cylinders moist by covering with wet burlap, or equivalent. Do not sprinkle water directly on the cylinders.
 - c. After 2 days, place the cylinders in a protective container for transport to the laboratory for testing. The concrete test cylinders are fragile and shall be handled carefully. The container may be a box with a Styrofoam or similar lining that will limit the jarring and bumping of the cylinders.
 - d. Place test cylinders in a moist curing room. Exercise caution in moving and transporting the cylinders since they are fragile and will withstand only minimal bumping, banging, or jolting without damage.
 - e. Do not remove the test cylinder from mold until the cylinder is to be capped and tested.
 - f. The test cylinders may be capped with standard sulfur compound or neoprene pads:
 - 1) Perform the capping carefully to prevent premature fractures.
 - 2) Use neoprene pads a minimum of 1/2 inch thick, and 1/2 inch larger in diameter than the test cylinders.
 - 3) Do not perform initial compression test until the cylinders reach a minimum age of 3 days.

3. Not less than 3 cylinder specimens will be tested for each 150 cubic yards of controlled low strength material and not less than 3 specimens for each half day's placement:
 - a. Test 1 cylinder at 3 days and 2 at 28 days in accordance with ASTM C 39 except as modified herein.
 - b. The compression strength of the cylinders tested at 28 days shall be equal to or greater than the minimum required compression strength, but shall not exceed maximum compression strength.
4. The OWNER will test the air content of the controlled low strength material. Test will be made immediately after discharge from the mixer in accordance with ASTM C 231.

C. Tests by CONTRACTOR:

1. Test the slump of controlled low strength material using a slump cone in accordance with ASTM C 143 with the following exceptions:
 - a. Do not rod the concrete material.
 - b. Place material in slump cone in one semi-continuous filling operation, slightly overfill, tap lightly, strike off, and then measure and record slump.
2. Test the slump at the beginning of each placement, as often as necessary to keep the slump within the specified range, and when requested to do so by the CM.

END OF SECTION

SECTION 02318

TRENCHING

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes: Trench excavation, fine grading, pipe bedding, backfilling, and compaction for the following, including requirements for ditch crossings:
 - 1. Pipes.
 - 2. Direct buried electrical and control conduits.
 - 3. Electrical and control duct banks.
 - 4. Manholes, valves, or other accessories.
 - 5. Potable water pipe appurtenances.
- B. Related sections:
 - 1. The Contract Documents are complementary; what is called for by one is as binding as if called for by all.
 - 2. It is the CONTRACTOR's responsibility for scheduling and coordinating the Work of subcontractors, suppliers, and other individuals or entities performing or furnishing any of CONTRACTOR's Work.
 - 3. The following Sections are related to the Work described in this Section. This list of Related Sections is provided for convenience only and is not intended to excuse or otherwise diminish the duty of the CONTRACTOR to see that the completed Work complies accurately with the Contract Documents.
 - a. Section 02050 - Basic Site Materials and Methods.
 - b. Section 02240 - Dewatering.
 - c. Section 02260 - Excavation Support and Protection.
 - d. Section 02312 - Controlled Low-Strength Material (CLSM).
 - e. Section 02300 - Earthwork.
 - f. Section 15956 - Piping Systems Testing.

1.02 REFERENCES

- A. ASTM International (ASTM):
 - 1. D 1556 - Standard Test Method for Density and Unit Weight of Soil in Place by the Sand Cone Method.
 - 2. D 1557 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³ (2,700 kN-m/m³)).
 - 3. D 2922 - Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
 - 4. D 3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).

1.03 SUBMITTALS

- A. Lab certification.
- B. Confirmation test reports.

1.04 QUALITY ASSURANCE

- A. Initial compaction demonstration:
 - 1. Adequacy of compaction equipment and procedures: Demonstrate adequacy of compaction equipment and procedures before exceeding any of following amounts of earthwork quantities:
 - a. 200 linear feet of trench backfill.
 - 2. Compaction sequence requirements: Until specified degree of compaction on previously specified amounts of earthwork is achieved, do not perform additional earthwork of the same kind.
 - 3. After satisfactory conclusion of initial compaction demonstration and at any time during construction, provide confirmation tests as specified under "FIELD QUALITY CONTROL."

PART 2 PRODUCTS

2.01 MATERIALS

- A. Soil and rock materials:
 - 1. Aggregate base course material: As specified in Section 02050.
 - 2. Gravel: As specified in Section 02050.
 - 3. Native material: As specified in Section 02050.
 - 4. Sand: As specified in Section 02050.
 - 5. Select material: As specified in Section 02050.
- B. Controlled low-strength material: As specified in Section 02312.

PART 3 EXECUTION

3.01 PREPARATION

- A. General:
 - 1. Embankment condition:
 - a. Exists where width of trench exceeds limits specified herein.
 - b. Before laying pipes in fill, place fill and compact it to not less than 2 feet above top of pipe.
 - c. After placing and compacting fill, excavate pipe trench through fill.
- B. Protection: Stabilize trench excavations as specified in Section 02260.

3.02 INSTALLATION

- A. Trench excavation:
 - 1. General requirements:
 - a. If, because of soil conditions, safety requirements, or other reasons, trench width at top of pipe is increased beyond width specified in this Section, upgrade laying conditions or install stronger pipe designed in conformance with Specifications for increased trench width, without additional cost to OWNER.
 - b. Excavate bottom of trench to depth indicated on the Drawings. The bottom of the trench excavation shall be firm and dry.

2. The trench may be excavated by machinery to the grade indicated on the Drawings provided that the soil material remaining in the bottom of the trench is no more than slightly disturbed.
3. Rock:
 - a. Pipe: If bottom of trench excavation is found to consist of rock or any material that by reason of its hardness cannot be excavated to provide uniform bearing surface, remove such rock or other material to a depth of not less than 4 inches below bottom of fine grading material. Backfill overcut with aggregate base course material compacted to 95 percent of maximum density up to bottom of fine grading material.
 - b. Direct buried electrical and control conduits: If bottom of trench excavation is found to consist of rock or any material that by reason of its hardness cannot be excavated to provide uniform bearing surface, remove such rock or other material to a depth of not less than 4 inches below bottom of conduit bedding material. Backfill overcut with aggregate base course material up to bottom of conduit bedding material.
 - c. Electrical and control ductbanks: If bottom of trench excavation is found to consist of rock or any material that by reason of its hardness cannot be excavated to provide uniform bearing surface, remove such rock or other material to a depth of not less than 4 inches below bottom of concrete ductbank. Backfill overcut with aggregate base course material up to bottom of concrete ductbank.
4. Overcut of trench bottom: Where the bottom of the trench is excavated below the depth indicated on the Drawings, restore trench bottom to proper grade by back filling with aggregate base course material compacted to 95 percent of maximum density, at no additional cost to OWNER.
5. Soft or unstable material:
 - a. If bottom of excavation is found to consist of soft or unstable material that is incapable of providing proper support, remove such material to a depth and for the length required, as determined by the ENGINEER. Backfill trench to bottom of fine grading material with aggregate base course material compacted to 90 percent of maximum density.
6. Trench widths:
 - a. Minimum clear width of trench for pipe (measured at top of pipe):
 - 1) For pipe sizes 4 inches to and including 24 inches: Not less than outside diameter of pipe plus 18 inches.
 - 2) For pipe sizes larger than 24 inches: Not less than outside diameter of pipe plus 24 inches.
 - b. Maximum clear width of trench for pipe (measured at top of pipe):
 - 1) For pipe sizes 4 inches to and including 24 inches: Not to exceed outside diameter of pipe plus 24 inches.
 - 2) For pipe sizes larger than 24 inches: Not to exceed outside diameter of pipe plus 36 inches.
7. For manholes, valves, or other accessories:
 - a. Provide excavations sufficient to leave at least 12 inches clear between their outer surfaces and sides of trench or shoring.
 - b. Backfilling of manhole excavation: Conform to backfilling requirements as specified for trenches in this Section.

- c. Backfill under manholes, vaults, tanks, or valves with aggregate base course material. Do not backfill with soil.
 - d. Fill any unauthorized excess excavation below elevation indicated on the Drawings for foundation of any structure with aggregate base course material at no additional cost to OWNER.
- 8. Potable water pipe appurtenances:
 - a. Lay in trenches separate from those used for sewers.
 - b. Unless otherwise specified or indicated on the Drawings, lay in trenches having cover of not less than 3 feet below surface of ground and located at distance of not less than 10 feet from any parallel sewer trench.
- 9. At road crossings or existing driveways:
 - a. Make provision for trench crossings at these points, either by means of backfills, tunnels, or temporary bridges.
- B. Dewatering: As specified in Section 02240.
- C. Pipe fine grading:
 - 1. Schedule fine grading material as specified in this Section.
 - 2. For pipes 16 inches in nominal diameter and under.
 - a. Place 4 inches of fine grading material below bottom of pipe.
 - b. Place fine grading material at uniform density, with minimum possible compaction.
 - 3. For pipe over 16 inches in diameter.
 - a. Place 4 inches, or 1/12 the outside diameter of pipe, whichever is greater, of fine grading material below bottom of pipe.
 - b. Place fine grading material at uniform density, with minimum possible compaction.
 - 4. Bell or coupling holes:
 - a. Dig holes after trench bottom has been graded.
 - b. Provide holes of sufficient width to provide ample room for grouting, banding, or welding.
 - c. Excavate holes only as necessary for making joints and to ensure that pipe rests upon prepared trench bottom and not supported by any portion of the joint.
 - 5. Depressions for joints, other than bell-and-spigot:
 - a. Make in accordance with recommendations of joint manufacturer for particular joint used.
- D. Pipe bedding:
 - 1. Schedule bedding material as specified in this Section.
 - 2. After pipe laid:
 - a. Place bedding material under and around pipe in 6-inch maximum lifts of bedding material, to level 12 inches above top of pipe. Compact to 90 percent of maximum density.
 - 3. Pipe displacement:
 - a. Take necessary precautions in placement and compaction of bedding material to prevent displacement of piping.
 - b. In event there is movement or floating of the piping, re-excavate, re-lay, and backfill the pipe.

- E. Trench backfill above pipe bedding, electrical and control conduit bedding, and electrical and control ductbanks:
 - 1. Under structures:
 - a. Backfill trench up to underside of structure with aggregate base course material as specified in Section 02050 compacted to 95 percent of maximum density or controlled low-strength material as specified in Section 02312.
 - 2. Cuts across roadways and paved streets:
 - a. Backfill trench to underside of pavement with aggregate base course material as specified in Section 02050 compacted to 95 percent of maximum density or controlled low-strength material as specified in Section 02312.
 - 3. Under and parallel to roadways, paved areas, or storage areas:
 - a. Backfill trench up to within 2 feet of finish grade with native material or select material as specified in Section 02050 compacted to 95 percent of maximum density.
 - b. Then backfill from 2 feet below finish grade to finish grade, or underside of aggregate base course or pavement as indicated on the Drawings with aggregate base course material as specified in Section 02050, compacted to 95 percent of maximum density.
 - 4. In areas outside the improved section of roadways or in open country:
 - a. Backfill to finish grade with native material as specified in Section 02050 compacted to 90 percent of maximum density.
 - 5. Through earth slopes adjacent to, or supporting structures:
 - a. Backfill to finish grade with aggregate base course material or select material compacted to 95 percent of maximum density.
- F. Under existing intersecting pipes or conduits larger than 3 inches in diameter:
 - 1. Backfill from bottom of new pipe trench to spring line of intersecting pipe or conduit with aggregate base course material, as specified in Section 02050, compacted to 90 percent of maximum density or controlled low-strength material as specified in Section 02312.
 - 2. Extend aggregate base course material as specified in Section 02050 or controlled low-strength material as specified in Section 02312, 2 feet on either side of intersecting pipe or conduit to ensure that material remains in place while other backfill is being placed.
 - 3. Backfill remainder of trench as specified in "Trench backfill above pipe bedding and for conduits and ductbanks" above.
- G. Compaction:
 - 1. In-place density of compacted trench backfill, and bedding determined in accordance with ASTM D 1556, or with ASTM D 2922 and ASTM D 3017.
 - 2. Maximum density obtained in laboratory when tested in accordance with ASTM D 1557.
 - 3. Consolidation:
 - a. Do not use water settling methods such as flooding, poling, or jetting.
- H. Excess material:
 - 1. Remove excess excavated material from the Project site as specified in Section 02300 and dispose of legally off site.

3.03 FIELD QUALITY CONTROL

A. Compliance Tests:

1. Testing:
 - a. Periodic compliance tests will be made by the CM to verify that compaction is meeting requirements previously specified.
 - b. Assist CM with taking samples for testing at no cost to the CONTRACTOR.
 - c. If Compaction Fails to Meet Specified Requirements: Perform remedial work by one of the following methods:
 - 1) Remove and replace backfill at proper density.
 - 2) Bring density up to specified level by other means acceptable to the CM.
 - 3) Cost of Compliance Tests: Paid for by the OWNER.
2. Retesting:
 - a. Costs of Retesting: Costs of retesting required to confirm and verify that remedial work has brought compaction within specified requirements shall be borne by the CONTRACTOR.

B. Water Testing Pipe:

1. After bedding the pipe, CONTRACTOR has the following option to:
 - a. Water-test pipe.
 - b. Backfill to surface, at his own risk, before water-testing pipe. Retesting will be required after backfilling is complete.
2. If pipe does not pass test, uncover pipe, locate leaks, repair and retest, repeating until pipe section under test passes.

3.04 SCHEDULES

A. Pipe fine grading materials:

1. Fine grading material shall be the same as bedding material.

B. Bedding materials:

1. Pipes:
 - a. For pipe less than 16-inch nominal size: Except as otherwise specified, use sand or aggregate base course material.
 - b. For pipe from 16- inch to 48-inch nominal size: Except as otherwise specified, use aggregate base course material.
 - c. For polyvinyl chloride or other plastic pipe less than 2 inches in diameter: Sand.

END OF SECTION

SECTION 02621

STABILIZATION FABRIC

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes: Woven stabilization fabric used for subgrade enhancement.

1.02 REFERENCES

- A. American Society for Testing and Materials (ASTM):
 - 1. D 3786 - Standard Test Method for Bursting Strength of Textile Fabric: Diaphragm Brushing Strength Tester Method.
 - 2. D 4533 - Standard Test Method for Trapezoid Tearing Strength of Geotextiles.
 - 3. D 4632 - Standard Test Method for Grab Breaking Load and Elongation of Geotextiles.
 - 4. D 4833 - Standard Test Method for Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products.

1.03 DEFINITIONS

- A. Stabilization Fabric: Woven geotextile fabric manufactured from polypropylene yarns.

1.04 SUBMITTALS

- A. Product data.
- B. Samples.
- C. Quality Control Submittals:
 - 1. Certificates of Compliance.
 - 2. Manufacturer's Installation Instructions.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Storage and Protection:
 - 1. Furnish stabilization fabric in protective covers capable of protecting the fabric from ultraviolet rays, abrasion, and water.

1.06 PROJECT CONDITIONS

- A. Field Measurements:
 - 1. Take field measurements to determine the exact lengths and dimensions of the surfaces to receive the fabric.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. One of the Following or Equal:
1. AmocoStyle 2006.
 2. Ten Cate Nicolon, Charlotte, NC, Mirafi 600X.

2.02 MATERIAL REQUIREMENTS

- A. Physical Properties: Meet the following minimum requirements:

Property⁽¹⁾	Test Method	Requirements⁽¹⁾
Grab Tensile Strength	ASTM D 4632	275 pounds
Mullen Burst Strength	ASTM D 3786	600 pounds per square inch
Trapezoid Tear Strength	ASTM D 4533	120 pounds
Puncture Strength	ASTM D 4833	120 pounds
<u>Notes:</u> (1) Minimum average roll values.		

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verification of Conditions: Verify that conditions are satisfactory for the installation of stabilization fabric.

3.02 PREPARATION

- A. Surface Preparation: During grading operations, take care not to disturb the subgrade. This may require use of lightweight dozers for low strength soils such as saturated, cohesionless, or low cohesion soils.
- B. Prior to Placement of Fabric: Prepare surface to smooth condition free of debris, depressions, or obstructions that may damage the fabric.

3.03 INSTALLATION

- A. Follow manufacturer's installation instructions and as complimented herein.
- B. Place the stabilization fabric smoothly without folds or wrinkles.
- C. Use special care when placing the stabilization fabric in contact with the soil so that no void spaces occur between the stabilization fabric and the prepared surface.
- D. Overlap the parallel rolls and ends of rolls a minimum of 24 inches and not less than recommended by manufacturer.
- E. Do not drag stabilization fabric across subgrade.

- F. Make overlaps at ends of rolls in the direction of the aggregate placement with the previous roll on top.
- G. Use lightweight dozers if necessary. Do not allow equipment directly on stabilization fabric.

3.04 FIELD QUALITY CONTROL

- A. Inspection: Before covering, the condition of the fabric will be observed by the CM to determine that no holes or rips exist in the fabric. Repair all holes or rips by placing a new layer of fabric extending beyond the defect in all directions a distance equal to the minimum overlap required for adjacent rolls.

END OF SECTION

SECTION 02742

ASPHALTIC CONCRETE PAVING

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes: Asphalt concrete pavement on prepared subgrade or aggregate base course, and on existing pavement, to lines, grades, compacted thicknesses, and cross sections indicated on the Drawings.

1.02 SYSTEM DESCRIPTION

- A. Performance Requirements
 - 1. Asphalt shall be placed in accordance with the standard specifications of the City of Camarillo, CA, which are included here by reference.

1.03 DELIVERY, STORAGE, AND HANDLING

- A. Asphalt Concrete Delivery:
 - 1. Transport the mixture from the mixing plant to the point of use in vehicles having tight bodies previously cleaned of all foreign materials.
 - 2. Treat bodies as necessary to prevent material from sticking to the bodies.
 - 3. Cover each load with canvas or other suitable material of sufficient size and thickness to protect the asphalt mixture from the weather.

1.04 PROJECT CONDITIONS

- A. Environmental Requirements:
 - 1. Asphalt Concrete:
 - a. Place asphalt concrete only when surface is dry, when atmospheric temperature in the shade is 40 degrees F and rising, or above 50 degrees F if falling.
 - b. Do not place asphalt concrete when weather is foggy or rainy nor when base on which material is to be placed is in wet or frozen condition.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Sand: Acceptable to the ENGINEER.
- B. Asphalt Concrete Materials:
 - 1. Asphalt Cement: Conform to requirements for asphalt cement, City of Camarillo, CA.

PART 3 EXECUTION

Not Used.

END OF SECTION

SECTION 02952

PAVEMENT RESTORATION AND REHABILITATION

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes:
 - 1. Resurfacing roads and paved surfaces in which surface is removed or damaged by installation of new work.
- B. Related sections:
 - 1. The Contract Documents are complementary; what is called for by one is as binding as if called for by all.
 - 2. It is the CONTRACTOR's responsibility for scheduling and coordinating the Work of subcontractors, suppliers, and other individuals or entities performing or furnishing any of CONTRACTOR's Work.
 - 3. The following Sections are related to the Work described in this Section. This list of Related Sections is provided for convenience only and is not intended to excuse or otherwise diminish the duty of the CONTRACTOR to see that the completed Work complies accurately with the Contract Documents.
 - a. Section 02050 - Basic Site Materials and Methods.
 - b. Section 02742 - Asphaltic Concrete Paving.
 - c. Section 03200 - Concrete and Reinforcing.

1.02 SYSTEM DESCRIPTION

- A. Performance requirements:
 - 1. Limiting dimensions:
 - a. Determine the exact lengths and dimensions of such roads, pavements, parking areas, and walks that will require removal and replacement for new work.
 - b. Join existing surfaces to terminals of new surfacing in smooth juncture.

1.03 SUBMITTALS

- A. Mix designs:
 - 1. Prior to placement of asphalt concrete, submit full details, including design and calculations for the asphalt concrete mix proposed.
 - 2. Submit gradation of aggregate base.
 - 3. Submit proposed mix design of portland cement concrete.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Aggregate base course: As specified in Section 02050.

- B. Asphalt pavement: As specified in Section 02742.
- C. Portland cement concrete replacement material: Class A concrete as specified in Section 03200.

2.02 EQUIPMENT

- A. Roads, pavements, parking areas, and walks:
 - 1. Equipment requirements: Good condition, capable of performing work intended in satisfactory manner.

2.03 ACCESSORIES

- A. Material for painting asphalt concrete pavement: Tack coat as specified in Section 02742.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Aggregate surface removal replacement:
 - 1. When trench cut is in aggregate surfaced areas, replace aggregate base course material with material matching existing material compacted to 95 percent of its maximum density.
- B. Pavement removal and temporary asphalt replacement:
 - 1. Install temporary asphalt pavement or first course of permanent pavement replacement immediately following backfilling and compaction of trenches that have been cut through existing pavement.
 - 2. Except as otherwise provided, maintain this temporary pavement in safe and reasonably smooth condition until required permanent pavement is installed.
 - 3. Remove and dispose of temporary paving from project site.
 - 4. Where longitudinal trench is partly in pavement, replace pavement to original pavement edge, on a straight line, parallel to centerline of roadway.
 - 5. Where no part of longitudinal trench is in pavement, surfacing replacement shall only be required where existing surfacing materials have been removed.
- C. Asphalt pavement replacement:
 - 1. Replace asphalt pavement to same thickness as adjacent pavement and match as nearly as possible adjacent pavement in texture, unless otherwise indicated on the Drawings.
 - 2. Cut existing asphalt pavements to be removed for trenches or other underground construction by wheel cutter, clay spade, or other device capable of making neat, reasonably straight and smooth cut without damaging adjacent pavement. Cutting device operation shall be subject to acceptance of CM.
 - 3. Cut and trim existing pavement after placement of required aggregate base course and just prior to placement of asphalt concrete for pavement replacement, and paint trimmed edges with material for painting asphalt concrete pavement immediately prior to constructing new abutting asphalt pavements. No extra payment will be made for these items, and all costs incurred in performing this work shall be incidental to pipe laying or pavement replacement.
 - 4. Conform replacement of asphalt pavement to contour of original pavement.

- D. Portland cement concrete pavement replacement:
 - 1. Where trenches lie within portland cement concrete section of streets, alleys, sidewalks, and similar concrete construction, saw cut such concrete (to a depth of not less than 1-1/2 inches) to neat, vertical, true lines in such manner adjoining surfaces are not damaged.
 - 2. Place portland cement concrete replacement material to dimension as indicated on the Drawings.
 - 3. Provide expansion joints that match existing.
 - 4. Before placing replacement concrete, thoroughly clean edges of existing pavement and wash with neat cement and water.
 - 5. Surface finish: Wood float finish.
- E. Curb, gutter, and sidewalk replacement:
 - 1. Where any concrete curb, gutter, or sidewalk has been removed or displaced, replace to nearest construction joints with new Class A curb, gutter, or sidewalk to same dimensions and finish as original construction that was removed:
 - a. Provide expansion joints of same spacing and thickness as original construction.
- F. Asphalt pavements:
 - 1. Trim existing asphalt pavements which are to be matched by pavement widening or pavement extension to neat true line with straight vertical edges free from irregularities with saw specifically designed for this purpose. Minimum allowable depth of cut shall be 1-1/2 inches.
 - 2. Cut and trim existing pavement after placement of required aggregate base course and just prior to placement of asphalt concrete for pavement widening or extension, and paint trimmed edges with material for painting asphalt concrete pavement immediately prior to constructing new abutting asphalt concrete pavements.
 - 3. No extra payment will be made for these items and all costs incurred in performing this work shall be incidental to widening or pavement extension.

3.02 FIELD QUALITY CONTROL

- A. Tests:
 - 1. Asphalt concrete as specified in Section 02742.
 - 2. Concrete as specified in Section 03200.
- B. Inspection:
 - 1. Asphalt concrete:
 - a. Lay 10-foot straightedge parallel to centerline of trench when the trenches run parallel to street, and across pavement replacement when trench crosses street at angle.
 - b. Remove and correct any deviation in cut pavement replacement greater than 1/4 inch in 10 feet.
 - 2. Portland cement concrete replacement pavement:
 - a. Lay 10-foot straightedge either across pavement replacement or longitudinal with centerline of gutter or ditch.
 - b. Remove and correct any deviation in cut pavement replacement greater than 1/4 inch in 10 feet.

END OF SECTION

SECTION 03200
CONCRETE AND REINFORCEMENT

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes: Concrete and reinforcement.

1.02 REFERENCES

- A. American Concrete Institute (ACI): Applicable codes and references.
- B. Standard Specifications for Public Works Construction (Greenbook, 2009 edition), for construction in Southern California.

1.03 SYSTEM DESCRIPTION

- A. All concrete and reinforcement shall meet the requirements of the Standard Specifications for Public Works Construction (Greenbook, 2009 edition), for construction in Southern California.

PART 2 PRODUCTS

2.01 STEEL REINFORCEMENT

- A. Steel reinforcement shall be Grade 60.

2.02 STRUCTURAL CONCRETE (CLASS A CONCRETE)

- A. Structural concrete shall be Class 650-C-4000; slump 3.5 inches maximum.
- B. Cement shall be ASTM C150, Type II.

2.03 MISCELLANEOUS CONCRETE

- A. Miscellaneous concrete shall be Class 520-C-2500; slump 4 inches maximum.

2.04 TRENCH BACKFILL SLURRY

- A. Trench backfill slurry shall be Class 100-E-100; slump 5 inches maximum.

2.05 CONTROLLED LOW-STRENGTH MATERIAL (CLSM)

- A. Use where approved or directed by ENGINEER.
- B. Unconfined compressive strength at 28 days: Between 50 and 100 psi.

PART 3 EXECUTION

Not Used.

END OF SECTION

SECTION 03200
CONCRETE AND REINFORCEMENT

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes: Concrete and reinforcement.

1.02 REFERENCES

- A. American Concrete Institute (ACI): Applicable codes and references.
- B. Standard Specifications for Public Works Construction (Greenbook, 2009 edition), for construction in Southern California.

1.03 SYSTEM DESCRIPTION

- A. All concrete and reinforcement shall meet the requirements of the Standard Specifications for Public Works Construction (Greenbook, 2009 edition), for construction in Southern California.

PART 2 PRODUCTS

2.01 STEEL REINFORCEMENT

- A. Steel reinforcement shall be Grade 60.

2.02 STRUCTURAL CONCRETE (CLASS A CONCRETE)

- A. Structural concrete shall be Class 650-C-4000; slump 3.5 inches maximum.
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- A. Miscellaneous concrete shall be Class 520-C-2500; slump 4 inches maximum.

2.04 TRENCH BACKFILL SLURRY

- A. Trench backfill slurry shall be Class 100-E-100; slump 5 inches maximum.

2.05 CONTROLLED LOW-STRENGTH MATERIAL (CLSM)

- A. Use where approved or directed by ENGINEER.
- B. Unconfined compressive strength at 28 days: Between 50 and 100 psi.

PART 3 EXECUTION

Not Used.

END OF SECTION

SECTION 09960B

COATINGS

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes: Field applied coatings.
- B. Related sections:
 - 1. The Contract Documents are complementary; what is called for by one is as binding as if called for by all.
 - 2. It is the CONTRACTOR's responsibility for scheduling and coordinating the Work of subcontractors, suppliers, and other individuals or entities performing or furnishing any of CONTRACTOR's Work.
 - 3. The following Sections are related to the Work described in this Section. This list of Related Sections is provided for convenience only and is not intended to excuse or otherwise diminish the duty of the CONTRACTOR to see that the completed Work complies accurately with the Contract Documents.
 - a. Section 01140 - Work Restrictions.
 - b. Section 01312 - Project Meetings.
 - c. Section 01330 - Submittal Procedures.
 - d. Section 01600 - Product Requirements.
 - e. Section 01770 - Closeout Procedures.

1.02 REFERENCES

- A. ASTM International (ASTM):
 - 1. D 4541 - Standard Test Method for Pull-off Strength of Coatings Using Portable Adhesion Testers.
- B. NACE International (NACE):
 - 1. SP0178 - Design, Fabrication, and Surface Finish Practices for Tanks and Vessels to Be Lined for Immersion Service.
 - 2. SP0188-06 - Discontinuity (Holiday) Testing of Protective Coatings.
- C. National Association of Pipe Fabricators (NAPF):
 - 1. 500-03 - Surface Preparation Standard for Ductile Iron Pipe and Fittings Receiving Special External Coatings and/or Special Internal Linings.
- D. NSF International (NSF):
 - 1. 61 - Drinking Water System Components - Health Effects.
- E. Society for Protective Coatings (SSPC):
 - 1. SP COM - Surface Preparation Commentary for Steel and Concrete Substrates.
 - 2. SP-1 - Solvent Cleaning.
 - 3. SP-2 - Hand Tool Cleaning.
 - 4. SP-3 - Power Tool Cleaning.
 - 5. SP-5 - White Metal Blast Cleaning.

- 6. SP-6 - Commercial Blast Cleaning.
 - 7. SP-7 - Brush-Off Blast Cleaning.
 - 8. SP-10 - Near-White Blast Cleaning.
- F. U.S. Environment Protection Agency (EPA):
- 1. Method 24 - Surface Coatings.

1.03 DEFINITIONS

- A. Submerged metal: Steel or iron surfaces below tops of channel or structure walls which will contain water even when above expected water level.
- B. Submerged concrete and masonry surfaces: Surfaces which are or will be:
 - 1. Underwater.
 - 2. In structures which normally contain water.
 - 3. Below tops of walls of water containing structures.
- C. Exposed surface: Any metal or concrete surface, indoors or outdoors that is exposed to view.
- D. Dry film thickness (DFT): Thickness of fully cured coating, measured in mils.
- E. Volatile organic compound (VOC): Content of air polluting hydrocarbons in uncured coating product measured in units of grams per liter or pounds per gallon, as determined by EPA Method 24.
- F. Ferrous: Cast iron, ductile iron, wrought iron, and all steel alloys except stainless steel.
- G. Where SSPC surface preparation standards are specified or implied for ductile iron pipe or fittings, the equivalent NAPF surface preparation standard shall be substituted for the SSPC standard.

1.04 PERFORMANCE REQUIREMENTS

- A. Coating materials shall be especially adapted for use in wastewater treatment plants.
- B. Coating materials used in contact with potable water supply systems shall be certified to NSF 61.

1.05 SUBMITTALS

- A. General: Submit in accordance with Section 01330.
- B. Shop drawings:
 - 1. Schedule of proposed coating materials.
 - 2. Schedule of surfaces to be coated with each coating material.

- C. Product Data: Include description of physical properties of coatings including solids content and ingredient analysis, VOC content, temperature resistance, typical exposures and limitations, and manufacturer's standard color chips:
 - 1. Regulatory requirements: Submit data concerning the following:
 - a. Volatile organic compound limitations.
 - b. Coatings containing lead compounds and PCBs.
 - c. Abrasives and abrasive blast cleaning techniques, and disposal.
 - d. NSF certification of coatings for use in potable water supply systems.
- D. Samples: Include 8-inch square drawdowns or brush-outs of topcoat finish when requested. Identify each sample as to finish, formula, color name and number and sheen name and gloss units.
- E. Certificates: Submit in accordance with requirements for Product Data.
- F. Manufacturer's Instructions: Include the following:
 - 1. Special requirements for transportation and storage.
 - 2. Mixing instructions.
 - 3. Shelf life.
 - 4. Pot life of material.
 - 5. Precautions for applications free of defects.
 - 6. Surface preparation.
 - 7. Method of application.
 - 8. Recommended number of coats.
 - 9. Recommended dry film thickness (DFT) of each coat.
 - 10. Recommended total dry film thickness (DFT).
 - 11. Drying time of each coat, including prime coat.
 - 12. Required prime coat.
 - 13. Compatible and non-compatible prime coats.
 - 14. Recommended thinners, when recommended.
 - 15. Limits of ambient conditions during and after application.
 - 16. Time allowed between coats (minimum and maximum).
 - 17. Required protection from sun, wind, and other conditions.
 - 18. Touch-up requirements and limitations.
 - 19. Minimum adhesion of each system submitted as per ASTM D 4541.
- G. Manufacturer's Representative's Field Reports.
- H. Operations and Maintenance Data: Submit as specified in Section 01770.
 - 1. Reports on visits to project site to view and approve surface preparation of structures to be coated.
 - 2. Reports on visits to project site to observe and approve coating application procedures.
 - 3. Reports on visits to coating plants to observe and approve surface preparation and coating application on items that are "shop coated."
- I. Quality Assurance Submittals:
 - 1. Quality Assurance plan.
 - 2. Qualifications of coating applicator including List of Similar Projects.

- J. California certifications:
 - 1. Submit Notarized Certificate that:
 - a. All paints and coatings to be used on this project comply with the State of California Air Resources Board Rule 1113 VOC Regulations effective as of January 1, 2004; and that
 - b. All paints and coatings to be used on this project comply with the VOC regulations of the State of California Air Management District in which the coatings will be used, effective January 1, 2004.

1.06 QUALITY ASSURANCE

- A. Applicator qualifications:
 - 1. Minimum of 5 years experience applying specified type or types of coatings under conditions similar to those of the Work:
 - a. Provide qualifications of applicator and references listing 5 similar projects completed in the past 2 years.
 - 2. Manufacturer approved applicator when manufacturer has approved applicator program.
 - 3. Approved and licensed by polymorphic polyester resin manufacturer to apply polymorphic polyester resin coating system.
 - 4. Approved and licensed by elastomeric polyurethane (100 percent solids) manufacturer to apply 100 percent solids elastomeric polyurethane system.
 - 5. Applicator of off-site application of coal tar epoxy shall have successfully applied coal tar epoxy on similar surfaces in material, size, and complexity as on the Project.
- B. Regulatory requirements: Comply with governing agencies regulations by using coatings that do not exceed permissible volatile organic compound limits and do not contain lead:
 - 1. Do not use coal tar epoxy in contact with drinking water or exposed to ultraviolet radiation.
- C. Certification: Certify that applicable pigments are resistant to discoloration or deterioration when exposed to hydrogen sulfide and other sewage gases and product data fails to designate coating as "fume resistant."
- D. Field samples: Prepare and coat a minimum 100 square foot area between corners or limits such as control or construction joints of each system. Approved field sample may be part of Work.
- E. Pre-installation conference: Conduct as specified in Section 01312.
- F. Compatibility of coatings: Use products by same manufacturer for prime coats, intermediate coats, and finish coats on same surface, unless specified otherwise.
- G. Services of coating manufacturers representative:
 - 1. Arrange for coating manufacturers representative to attend pre-installation conferences.
 - 2. Make periodic visits to the project site to provide consultation and inspection services during surface preparation and application of coatings, and to make visits to coating plants to observe and approve surface preparation procedures and coating application of items to be "shop primed and coated."

1.07 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle products as specified in Section 01600.
- B. Remove unspecified and unapproved paints from Project site immediately.
- C. Deliver new unopened containers with labels identifying the manufacturer's name, brand name, product type, batch number, date of manufacturer, expiration date or shelf life, color, and mixing and reducing instructions.
 - 1. Do not deliver materials aged more than 12 months from manufacturing date.
- D. Store coatings in well-ventilated facility that provides protection from the sun, weather, and fire hazards. Maintain ambient storage temperature between 45 and 90 degrees Fahrenheit, unless otherwise recommended by the manufacturer.
- E. Take precautions to prevent fire and spontaneous combustion.

1.08 PROJECT CONDITIONS

- A. Surface moisture contents: Do not coat surfaces that exceed manufacturer specified moisture contents.
- B. Do not apply coatings:
 - 1. Under dusty conditions or adverse environmental conditions, unless tenting, covers, or other such protection is provided for structures to be coated.
 - 2. When light on surfaces measures less than 15 foot-candles.
 - 3. When ambient or surface temperature is less than 55 degrees Fahrenheit unless manufacturer allows a lower temperature.
 - 4. When relative humidity is higher than 85 percent.
 - 5. When surface temperature is less than 5 degrees Fahrenheit above dew point.
 - 6. When surface temperature exceeds the manufacturer's recommendation.
 - 7. When ambient temperature exceeds 90 degrees Fahrenheit, unless manufacturer allows a higher temperature.
 - 8. Apply clear finishes at minimum 65 degrees Fahrenheit.
- C. Provide fans, heating devices, dehumidifiers, or other means recommended by coating manufacturer to prevent formation of condensate or dew on surface of substrate, coating between coats and within curing time following application of last coat.
- D. Provide adequate continuous ventilation and sufficient heating facilities to maintain minimum 55 degrees Fahrenheit for 24 hours before, during and 48 hours after application of finishes.

1.09 SEQUENCING AND SCHEDULING

- A. Sequence and Schedule: As specified in Section 01352.

1.10 MAINTENANCE

- A. Extra materials: Deliver as specified in Section 01770. Include minimum 1 gallon of each type and color of coating applied:
 - 1. When manufacturer packages material in gallon cans, deliver unopened labeled cans as comes from factory.
 - 2. When manufacturer does not package material in gallon cans, deliver material in new gallon containers, properly sealed and identified with typed labels indicating brand, type, and color.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Special coatings: One of the following or equal:
 - 1. Carboline: Carboline, St. Louis, MO.
 - 2. Ceilcote: Ceilcote Corrosion Control, Berea, OH.
 - 3. Dampney: The Dampney Company, Everett, MA.
 - 4. Devoe: ICI Devoe Coatings, Louisville, KY.
 - 5. Dudick: Dudick, Inc., Streetsboro, OH.
 - 6. GET: Global Eco Technologies, Pittsburg, CA.
 - 7. Henkel: Henkel North America, Madison Heights MI.
 - 8. IET: Integrated Environmental Technologies, Santa Barbara, CA.
 - 9. PPC: Polymorphic Polymers Corp., N. Miami, FL.
 - 10. PPG Amercoat: PPG Protective & Marine Coatings, Brea, CA.
 - 11. Sanchem: Sanchem, Chicago, IL.
 - 12. Superior: Superior Environmental Products, Inc., Addison, TX.
 - 13. S-W: Sherwin-Williams Co., Cleveland, OH.
 - 14. Tnemec: Tnemec Co., Kansas City, MO.
 - 15. Wasser: Wasser High Tech Coatings, Kent, WA.

2.02 PREPARATION AND PRETREATMENT MATERIALS

- A. Metal pretreatment: As manufactured by one of the following or equal:
 - 1. Henkel: Galvaprep 5.
 - 2. International: AWLGrip Alumiprep 33.
- B. Surface cleaner and degreaser: As manufactured by one of the following or equal:
 - 1. Carboline Surface Cleaner No. 3.
 - 2. Devoe: Devprep 88.
 - 3. S-W: Clean and Etch.

2.03 COATING MATERIALS

- A. Alkali resistant bitumastic: As manufactured by one of the following or equal:
 - 1. As specified for Coal Tar Epoxy Substitute.

- B. High solids epoxy (self priming) not less than 72 percent solids by volume with a mixed applied flash point of 140 degrees Fahrenheit or less: As manufactured by one of the following or equal:
 - 1. Carboline:
 - a. Non-submerged: Carboguard 890 VOC.
 - b. Submerged: Phenoline 341 (100 percent solids, 2 component epoxy).
 - 2. Devoe:
 - a. Bar Rust 233 Low VOC.
 - b. Devran 133 (100 percent solids, 2 component epoxy).
 - 3. S-W: Macropoxy 646-100.
 - 4. PPG Amercoat: Amerlock 2 VOC.
- C. Aliphatic or aliphatic-acrylic polyurethane not less than 80 percent solids with a mixed flash point of 140 degrees Fahrenheit or less: As manufactured by one of the following or equal:
 - 1. Carboline: Carbothane 134MC.
 - 2. Devoe: Devthane 379 H.
 - 3. S-W: High Solids Polyurethane 100.
 - 4. PPG Amercoat: Amershield VOC.
- D. Asphalt varnish: AWWA C 500.
- E. Coal tar: Where coal tar, coal tar epoxy, or coal tar mastic are specified or indicated on the Drawings, coal tar epoxy substitute, as specified, shall be used in their place. Coal tar shall not be allowed.
- F. Coal tar epoxy substitute: As manufactured by one of the following or equal:
 - 1. Devoe: Devtar 5A HS.
 - 2. S-W: Macropoxy 646 Black.
- G. Vinyl Ester: Glass mat reinforced, total system 125 mils DFT, manufacturer's recommended top coat. As manufactured by one of the following or equal:
 - 1. Carboline: Semstone 870.
 - 2. Dudick: Protecto-Flex 800.
 - 3. S-W: Duraplate UHS.
 - 4. Tnemec: Chemtread Series 239SC.
- H. Elastomeric polyurethane 100 percent solids, ASTM D 16, Type V, (Urethane P): As manufactured by the following or equal:
 - 1. GET: Endura-Flex EF-1988.
- I. Waterborne acrylic emulsion: As manufactured by one of the following or equal:
 - 1. S-W: DTM Acrylic B66W1.
 - 2. Tnemec: Tneme-Cryl Series 6.

2.04 MIXES

- A. Mix epoxy parts in accordance with manufacturer's instructions.

PART 3 EXECUTION

3.01 GENERAL PROTECTION

- A. Protect adjacent surfaces from coatings and damage. Repair damage resulting from inadequate or unsuitable protection:
- B. Protect adjacent surfaces not to be coated from spatter and droppings with drop cloths and other coverings:
 - 1. Mask off surfaces of items not to be coated or remove items from area.
- C. Furnish sufficient drop cloths, shields, and protective equipment to prevent spray or droppings from fouling surfaces not being coated and in particular, surfaces within storage and preparation area.
- D. Place cotton waste, cloths, and material which may constitute fire hazard in closed metal containers and remove daily from site.
- E. Remove surface hardware, fittings, and fastenings, prior to application of coating operations. Carefully store, clean, and replace on completion of coating in each area. Do not use solvent or degreasers to clean hardware that may remove permanent lacquer finish.

3.02 GENERAL PREPARATION

- A. Prepare surfaces in accordance with coating manufacturer's instructions, unless more stringent requirements are specified in this Section.
- B. Protect following surfaces from abrasive blasting by masking, or other means:
 - 1. Threaded portions of valve and gate stems, grease fittings, and identification plates.
 - 2. Machined surfaces for sliding contact.
 - 3. Surfaces to be assembled against gaskets.
 - 4. Surfaces of shafting on which sprockets are to fit.
 - 5. Surfaces of shafting on which bearings are to fit.
 - 6. Machined surfaces of bronze trim, including those slide gates.
 - 7. Cadmium-plated items except cadmium-plated, zinc-plated, or sherardized fasteners used in assembly of equipment requiring abrasive blasting.
 - 8. Galvanized items, unless scheduled to be coated.
- C. Protect installed equipment, mechanical drives, and adjacent coated equipment from abrasive blasting to prevent damage caused by entering sand or dust.
- D. Ferrous metal surfaces:
 - 1. Remove grease and oil in accordance with SSPC SP-1.
 - 2. Remove rust, scale, and welding slag and spatter, and prepare surfaces in accordance with appropriate SSPC standard as specified.
 - 3. Abrasive blast surfaces prior to coating.
 - 4. When abrasive blasted surfaces rust or discolor before coating, abrasive blast surfaces again to remove rust and discoloration.

5. When metal surfaces are exposed because of coating damage, abrasive blast surfaces and feather in to a smooth transition before touching-up.
 6. All abrasive blast cleaned surfaces shall be blown down with clean dry air and or vacuumed.
- E. Ferrous metal surfaces not to be submerged: Abrasive blast in accordance with SSPC SP-10, unless blasting may damage adjacent surfaces, prohibited or specified otherwise. Where not possible to abrasive blast, power tool clean surfaces in accordance with SSPC SP-3.
- F. Ferrous metal surfaces to be submerged: Unless specified otherwise, abrasive blast in accordance with SSPC SP-5 to clean and provide roughened surface profile of not less than 2 mils and not more than 4 mils in depth when measured with Elcometer 123, or as recommended by the coating manufacturer.
- G. Ductile iron pipe and fittings to be lined or coated: Abrasive blast clean in accordance with NAPF 500-03.
- H. Sherardized, aluminum, copper, and bronze surfaces: Prepare in accordance with coating manufacturer's instructions.
- I. Galvanized surface:
1. Degrease or solvent clean (SSPC SP-1) to remove oily residue.
 2. Power tool or hand tool clean or whip abrasive blast.
 3. Test surface for contaminants using copper sulfate solution.
 4. Apply metal pretreatment within 24 hours before coating galvanized surfaces that cannot be thoroughly abraded physically, such as bolts, nuts, or preformed channels.
- J. Shop primed metal:
1. Certify that primers applied to metal surfaces in the shop are compatible with coatings to be applied over such primers in the field.
 2. Remove shop primer from metal to be submerged by abrasive blasting in accordance with SSPC SP-10, unless greater degree of surface preparation is required by coating manufacturer's representative.
 3. Correct abraded, scratched, or otherwise damaged areas of prime coat by sanding or abrasive blasting to bare metal in accordance with SSPC SP-2, SP-3, or SP-6, as directed by the ENGINEER.
 4. When entire shop priming fails or has weathered excessively (more than 25 percent of the item), or when recommended by coating manufacturer's representative, abrasive blast shop prime coat to remove entire coat and prepare surface in accordance with SSPC SP-10.
 5. When incorrect prime coat is applied, remove incorrect prime coat by abrasive blasting in accordance with SSPC SP-10.
 6. When prime coat not authorized by ENGINEER is applied, remove unauthorized prime coat by abrasive blasting in accordance with SSPC SP-10.
 7. Shop applied bituminous paint or asphalt varnish: Abrasive blast clean shop applied bituminous paint or asphalt varnish from surfaces scheduled to receive non-bituminous coatings.
- K. Abrasive blast cadmium-plated, zinc-plated, or sherardized fasteners in same manner as unprotected metal when used in assembly of equipment designated for abrasive blasting.

- L. Abrasive blast components to be attached to surfaces which cannot be abrasive blasted before components are attached.
- M. Grind sharp edges to approximately 1/16-inch radius before abrasive blast cleaning.
- N. Remove and grind smooth all excessive weld material and weld spatter before blast cleaning in accordance with NACE SP0178.
- O. PVC and FRP surfaces:
 - 1. Prepare surfaces to be coated by light sanding (de-gloss) and wipe-down with clean cloths, or by solvent cleaning in strict accordance with coating manufacturer's instructions.
- P. Cleaning of previously coated surfaces:
 - 1. Use cleaning agent to remove soluble salts such as chlorides and sulfates from concrete and metal surfaces:
 - a. Cleaning agent: Biodegradable non-flammable and containing no volatile organic compounds.
 - b. Manufacturer: The following or equal.
 - 1) Chlor-Rid International, Inc.
 - 2. Cleaning of surfaces using the decontamination cleaning agent may be accomplished in conjunction with abrasive blast cleaning, steam cleaning, high pressure, washing, or hand washing as approved by the coating manufacturer's representative and the ENGINEER.
 - 3. Test cleaned surfaces in accordance with the cleaning agent manufacturer's instructions to ensure all soluble salts have been removed. Additional cleaning shall be carried out as necessary.
 - 4. Final surface preparation prior to application of new coating system shall be made in strict accordance with coating manufacturer's printed instructions.

3.03 MECHANICAL AND ELECTRICAL EQUIPMENT PREPARATION

- A. Prepare and finish coat-primed equipment with color selected by the OWNER.
- B. Prepare and prime and coat insulated and bare pipes, boxes, insulated and bare ducts, hangers, brackets, collars, and supports, except where items are covered with prefinished coating.
- C. Replace identification markings on mechanical or electrical equipment when coated over or spattered.
- D. Prepare and coat exposed conduit and electrical equipment occurring in finished areas with color and texture to match adjacent surfaces.
- E. Color code equipment, piping, conduit and exposed ductwork and apply color banding and identification, such as flow arrows, naming and numbering, in accordance with Contract Documents.

3.04 GENERAL APPLICATION REQUIREMENTS

- A. Apply coatings in accordance with manufacturer's instructions.

- B. Coat metal unless specified otherwise:
 - 1. Aboveground piping to be coated shall be empty of contents during application of coatings.
- C. Verify metal surface preparation immediately before applying coating in accordance with SSPC SP COM.
- D. Allow surfaces to dry, except where coating manufacturer requires surface wetting before coating.
- E. Wash coat and prime sherardized, aluminum, copper, and bronze surfaces, or prime with manufacturer's recommended special primer.
- F. Prime shop primed metal surfaces. Spot prime exposed metal of shop primed surfaces before applying primer over entire surface.
- G. Apply minimum number of specified coats.
- H. Apply coats to thicknesses specified, especially at edges and corners.
- I. Apply additional coats when necessary to achieve specified thicknesses.
- J. Coat surfaces without drops, overspray, dry spray, runs, ridges, waves, holidays, laps, or brush marks.
- K. Remove spatter and droppings after completion of coating.
- L. When multiple coats of same material are specified, tint prime coat and intermediate coats with suitable pigment to distinguish each coat.
- M. Dust coatings between coats. Lightly sand and dust surfaces to receive high gloss finishes, unless instructed otherwise by coating manufacturer.
- N. Apply coating by brush, roller, trowel, or spray, unless particular method of application is required by coating manufacturer's instructions or these Specifications.
- O. Plural component application: Drums shall be premixed each day. All gauges shall be working order prior to the start of application. Ratio checks shall be completed prior to each application. A spray sample shall be sprayed on plastic sheeting to insure set time is complete prior to each application. Hardness testing shall be preformed after each application.
- P. Spray application:
 - 1. Stripe coat edges, welds, nuts, bolts, difficult to reach areas by brush before beginning spray application, as necessary, to ensure specified coating thickness along edges.
 - 2. When using spray application, apply coating to thickness not greater than that recommended in coating manufacturer's instructions for spray coat application.
 - 3. Use airless spray method, unless air spray method is required by coating manufacturer's instruction or these Specifications.
 - 4. Conduct spray coating under controlled conditions. Protect adjacent construction and property from coating mist, fumes, or overspray.

Q. Drying and recoating:

1. Provide fans, heating devices, or other means recommended by coating manufacturer to prevent formation of condensate or dew on surface of substrate, coating between coats and within curing time following application of last coat.
2. For submerged service the CONTRACTOR shall provide a letter to the ENGINEER that the lining system is fully cured and ready to be placed into service.
3. Limit drying time to that required by these Specifications or coating manufacturer's instructions.
4. Do not allow excessive drying time or exposure which may impair bond between coats.
5. Recoat epoxies within time limits recommended by coating manufacturer.
6. When time limits are exceeded, abrasive blast and de-gloss clean prior to applying another coat.
7. When limitation on time between abrasive blasting and coating cannot be met before attachment of components to surfaces which cannot be abrasive blasted, coat components before attachment.
8. Ensure primer and intermediate coats of coating are unscarred and completely integral at time of application of each succeeding coat.
9. Touch up suction spots between coats and apply additional coats where required to produce finished surface of solid, even color, free of defects.
10. Leave no holidays.
11. Sand and feather in to a smooth transition and recoat scratched, contaminated, or otherwise damaged coating surfaces so damages are invisible to naked eye.

R. Concrete:

1. Apply first coat (primer) only when surface temperature of concrete is decreasing in order to eliminate effects of off-gassing on coating.

3.05 ALKALI RESISTANT BITUMASTIC

A. Preparation:

1. Prepare surfaces in accordance with general preparation requirements.

B. Application:

1. Apply in accordance with general application requirements and as follows:
 - a. Apply at least 2 coats, 8 to 14 mils dry film thickness each.

3.06 HIGH SOLIDS EPOXY SYSTEM

A. Preparation:

1. Prepare surfaces in accordance with general preparation requirements and as follows:
 - a. Abrasive blast ferrous metal surfaces to be submerged at jobsite in accordance with SSPC SP-5 prior to coating. When cleaned surfaces rust or discolor, abrasive blast surfaces in accordance with SSPC SP-10.

- b. Abrasive blast non-submerged ferrous metal surfaces at jobsite in accordance with SSPC SP-10, prior to coating. When cleaned surfaces rust or discolor, abrasive blast surfaces in accordance with SSPC SP- 6.
- c. Abrasive blast clean ductile iron surfaces at jobsite in accordance with SSPC SP-7.

B. Application:

- 1. Apply coatings in accordance with general application requirements and as follows:
 - a. Apply minimum 2-coat system with minimum total dry film thickness (DFT) of 12 mils.
 - b. Recoat or apply succeeding epoxy coats within time limits recommended by manufacturer. Prepare surfaces for recoating in accordance with manufacturer's instructions.
 - c. Coat metal to be submerged before installation when necessary, to obtain acceptable finish and to prevent damage to other surfaces.
 - d. Coat entire surface of support brackets, stem guides, pipe clips, fasteners, and other metal devices bolted to concrete.
 - e. Coat surface of items to be exposed and adjacent 1 inch to be concealed when embedded in concrete or masonry.

3.07 HIGH SOLIDS EPOXY AND POLYURETHANE COATING SYSTEM

A. Preparation:

- 1. Prepare surfaces in accordance with general preparation requirements and as follows:
 - a. Prepare concrete surfaces in accordance with general preparation requirements.
 - b. Touch up shop primed steel and miscellaneous iron.
 - c. Abrasive blast ferrous metal surfaces at jobsite in accordance with SSPC SP-6, prior to coating. When cleaned surfaces rust or discolor, abrasive blast surfaces in accordance with SSPC SP-6.
 - d. Degrease or solvent clean, whip abrasive blast, power tool, or hand tool clean galvanized metal surfaces.
 - e. Lightly sand (de-gloss) fiberglass and poly vinyl chloride (PVC) pipe to be coated and wipe clean with dry cloths, or solvent clean in accordance with coating manufacturer's instructions.
 - f. Abrasive blast clean ductile iron surfaces.

B. Application:

- 1. Apply coatings in accordance with general application requirements and as follows:
 - a. Apply 3 coat system consisting of:
 - 1) Primer: 4 to 5 mils dry film thickness high solids epoxy.
 - 2) Intermediate coat: 4 to 5 mils dry film thickness high solids epoxy .
 - 3) Top coat: 2.5 to 3.5 mils dry film thickness aliphatic or aliphatic-acrylic polyurethane topcoat.
- 2. Recoat or apply succeeding epoxy coats within time limits recommended by manufacturer. Prepare surfaces for recoating in accordance with manufacturer's instructions.

3.08 ASPHALT VARNISH

- A. Preparation:
 - 1. Prepare surfaces in accordance with general preparation requirements.
- B. Application:
 - 1. Apply coatings in accordance with general application requirements and as follows:
 - a. Apply minimum 2 coats.

3.09 COAL TAR EPOXY SUBSTITUTE

- A. Preparation:
 - 1. Prepare surfaces in accordance with general preparation requirements and in accordance with the coating manufacturer's printed instructions.
- B. Application:
 - 1. Apply 2 coats at 6 mils to 8 mils each, for a minimum total DFT of 12 mils.

3.10 ELASTOMERIC POLYURETHANE (100 PERCENT SOLIDS)

- A. Application:
 - 1. Apply epoxy primer at DFT of 1 to 2 mils, in strict accordance with manufacturer's instructions.

3.11 WATERBORNE ACRYLIC EMULSION

- A. Preparation:
 - 1. Remove all oil, grease, dirt, and other foreign material by Solvent Cleaning in accordance with SSPC SP-1.
 - 2. Lightly sand all surfaces and wipe thoroughly with clean cotton cloths before applying coating.
- B. Application:
 - 1. Apply 2 or more coats to obtain a minimum dry film thickness (DFT) of 5.0 mils.

3.12 FIELD QUALITY CONTROL

- A. Each coat will be inspected. Strip and remove defective coats, prepare surfaces and recoat. When approved, apply next coat.
- B. Control and check dry film thicknesses and integrity of coatings.
- C. Measure dry film thickness with calibrated thickness gauge.
- D. Dry film thicknesses on ferrous-based substrates may be checked with Elcometer Type 1 Magnetic Pull-Off Gage or Elcometer 456.
- E. Verify coat integrity with low-voltage holiday detector, in accordance with SP0188-06. Allow CM to use detector for additional checking.

- F. Check wet film thickness before coal tar epoxy coating cures on concrete or non-ferrous metal substrates.
- G. Arrange for services of coating manufacturer's field representative to provide periodic field consultation and inspection services to ensure proper surface preparation of facilities and items to be coated, and to ensure proper application and curing:
 - 1. Notify CM 24 hours in advance of each visit by coating manufacturer's representative.
 - 2. Provide CM with a written report by coating manufacturer's representative within 48 hours following each visit.

3.13 SCHEDULE OF ITEMS NOT REQUIRING COATING

- A. General: Unless specified otherwise, the following items do not require coating:
 - 1. Items that have received final coat at factory and not listed to receive coating in field.
 - 2. Aluminum, brass, bronze, copper, plastic (except PVC pipe), rubber, stainless steel, chrome, Everdur, or lead.
 - 3. Buried or encased piping or conduit.
 - 4. Exterior concrete.
 - 5. Galvanized items:
 - a. Areas on galvanized items or parts where galvanizing has been damaged during handling or construction shall be repaired as follows:
 - 1) Clean damaged areas by SSPC SP-1, SP-2, SP-3, or SP-7 as required.
 - 2) Apply 2 coats of a cold galvanizing zinc compound such as ZRC World Wide Inovatie Zinc Technologies of Mansfield, MA or accepted equal, in strict accordance with manufacturer's instructions.
 - 6. Grease fittings.
 - 7. Steel to be encased in concrete or masonry.

3.14 SCHEDULE OF SURFACES TO BE COATED IN THE FIELD

- A. In general, apply coatings to steel, iron, galvanized surfaces, and wood surfaces unless specified or otherwise indicated on the Drawings. Coat concrete surfaces and anodized aluminum only when specified or indicated on the Drawings. Color coat all piping as specified in Section 15075.
- B. Following schedule is incomplete. Coat unlisted surfaces with same coating system as similar listed surfaces. Verify questionable surfaces.
- C. Metals:
 - 1. Alkali resistant bitumastic:
 - a. Aluminum surfaces to be placed in contact with wood, concrete, or masonry.
 - 2. High solids epoxy and polyurethane system: Exterior non-immersed ferrous metal surfaces including:
 - a. Exposed sheet metal.
 - b. Pipe, valves, pipe hangers, supports and saddles, conduit, cable tray hangers, and supports.
 - c. Valve and gate operators and stands.
 - d. Structural steel including galvanized structural steel.

- e. Mechanical equipment supports and accessories.
- f. Other miscellaneous metals.
- 3. High solids epoxy system:
 - a. Field priming of ferrous metal surfaces with defective shop prime coat where no other prime coat is specified; for non-submerged service.
 - b. Bell rings, underside of manhole covers and frames.
 - c. Exterior of submerged piping and valves other than stainless steel, HDPE, or PVC piping.
 - d. Other submerged iron and steel metal unless specified otherwise.
 - e. Submerged piping.
- 4. Asphalt varnish:
 - a. Underground valves and valve boxes.
- 5. Coal tar epoxy substitute:
 - a. Underground pipe flanges, excluding pipe and miscellaneous underground metals not otherwise specified to receive another protective coating.
 - b. Aluminum surfaces to be placed in contact with wood, concrete, or masonry.
- 2. Waterborne acrylic emulsion:
 - a. Fiberglass expose to sunlight.
 - b. PVC piping exposed to view.

END OF SECTION

SECTION 15052

BASIC PIPING MATERIALS AND METHODS

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes: Basic piping materials and methods.
- B. Related sections:
 - 1. The Contract Documents are complementary; what is called for by one is as binding as if called for by all.
 - 2. It is the CONTRACTOR's responsibility for scheduling and coordinating the Work of subcontractors, suppliers, and other individuals or entities performing or furnishing any of CONTRACTOR's Work.
 - 3. The following Sections are related to the Work described in this Section. This list of Related Sections is provided for convenience only and is not intended to excuse or otherwise diminish the duty of the CONTRACTOR to see that the completed Work complies accurately with the Contract Documents.
 - a. Section 01140 - Work Restrictions.
 - b. Section 09960B - Coatings.
 - c. Section 15251 - Ductile Iron AWWA C151 Pipe.
 - d. Section 15265 - Plastic Piping and Tubing.
 - e. Section 15267 - High Density Polyethylene (HDPE) Piping.
 - f. Section 15956 - Piping Systems Testing.

1.02 REFERENCES

- A. American Society of Mechanical Engineers (ASME):
 - 1. B16.5 - Pipe Flanges and Flanged Fittings: NPS 1/2 Through 24.
 - 2. B16.47 - Large Diameter Steel Flanges: NPS 26 Through NPS 60 Metric/Inch Standard.
- B. American Water Works Association (AWWA):
 - 1. C207 - Standard for Steel Pipe Flanges for Waterworks Services-Size 4 Inches Through 144 Inches.
- C. ASTM International (ASTM):
 - 1. A 193 - Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High Temperature or High Pressure Service and Other Special Purpose Applications.
 - 2. A 194 - Standard Specification for Carbon and Alloy Steel Nuts for Bolts for High Pressure or High Temperature Service, or Both.
 - 3. A 307 - Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
 - 4. F 37 - Standard Test Methods for Sealability of Gasket Materials.
- D. California Health and Safety Code.

1.03 DEFINITIONS

- A. Buried pipe: Pipe that is buried in the soil, or cast in a concrete pipe encasement that is buried in the soil.
- B. Exposed pipe: Pipe that is located above ground, or pipe that is located inside a structure, supported by a structure, or cast into a concrete structure.
- C. Underground piping: Piping actually buried in soil or cast in concrete that is buried in soil.
- D. Underwater piping: Piping below tops of walls in basins or tanks containing water.
- E. Wet wall: Wall with water on at least 1 side.

1.04 SUBMITTALS

- A. Product data:
 - 1. Flange bolts.
 - 2. Gaskets.

PART 2 PRODUCTS

2.01 FLANGE BOLTS

- A. Ductile iron pipe:
 - 1. Bolts and nuts for ductile iron pipe flanges located indoors, outdoors above ground, or in dry vaults and structures shall be carbon steel, ASTM A 307, Grade B.
 - 2. Bolts and nuts for ductile iron pipe flanges located indoors, outdoors above ground, or in dry vaults and structures where the pressures exceed 150 pounds per square inch shall be alloy steel, ASTM A 193, Grade B7.
 - 3. Bolts and nuts for ductile iron pipe flanges submerged in water or wastewater, buried, in wet vaults or structures, adjacent to wet walls, or above open water-containing structures shall be Type 316 stainless steel in accordance with ASTM A 193, Grade B8M for bolts and in accordance with ASTM A 194, Grade 8M for nuts.
 - 4. Bolts and nuts for ductile iron pipe flanges buried shall be Type 316 stainless steel in accordance with ASTM A 193, Grade B8M for bolts and in accordance with ASTM A 194, Grade 8M for nuts.
 - 5. Provide a washer for each nut. Washer shall be of the same material as the nut.
 - 6. Nuts shall be Heavy hex-head, Type 2H.
 - 7. Cut and finish flange bolts to project a maximum of 1/4 inch beyond outside face of nut after assembly.
 - 8. Tap holes for cap screws or stud bolts when used.
- B. Lubricant for stainless steel bolts and nuts:
 - 1. Chloride-free.
 - 2. Manufacturers: One of the following or equal:
 - a. Huskey FG-1800.

C. Plastic pipe:

1. Bolts and nuts for flanges on plastic pipe located indoors, outdoors above ground, or in dry vaults and structures shall be carbon steel, in accordance with ASTM A 307, Grade B.
2. Bolts and nuts for flanges on plastic pipe submerged in water or wastewater, buried, in wet vaults or structures, adjacent to wet walls, or above open water-containing structures and plastic pipe carrying corrosive chemicals shall be Type 316 stainless steel in accordance with ASTM A 193, Grade B8M for bolts and in accordance with ASTM A 194, Grade 8M for nuts.
3. Provide a washer for each nut. Washer shall be of the same material as the nut.
4. Nuts shall be Heavy hex-head.
5. Cut and finish flange bolts to project a maximum of 1/4 inch beyond outside face of nut after assembly.
6. Tap holes for cap screws or stud bolts when used.

D. Steel pipe:

1. Bolts and nuts for ASME B16.5 Class 150 flanges and AWWA C207 Class D flanges located indoors, outdoors above ground, or in dry vaults and structures shall be carbon steel, ASTM A 307, Grade B.
2. Bolts and nuts for ASME B16.5 and B16.47 Class 300 flanges and AWWA C207 Class E and F flanges located indoors, outdoors above ground, or in dry vaults and structures in accordance with ASTM A 193, Grade B7 for bolts and in accordance with ASTM A 194, Grade 7 for nuts.
3. Bolts and nuts for flanges submerged in water or wastewater, buried, in wet vaults or structures, adjacent to wet walls, or above open water-containing structures shall be Type 316 stainless steel in accordance with ASTM A 193, Grade B8M for bolts and in accordance with ASTM A 194, Grade 8M for nuts.
4. Provide a washer for each nut. Washer shall be of the same material as the nut.
5. Nuts shall be Heavy hex-head, Type 2H.
6. Cut and finish flange bolts to project a maximum of 1/4 inch beyond outside face of nut after assembly.
7. Tap holes for cap screws or stud bolts when used.

2.02 GASKETS

A. Gaskets for non-steam cleaned ductile iron and steel piping:

1. Suitable for pressures equal to and less than 150 pounds per square inch gauge, temperatures equal to or less than 250 degrees F, and raw sewage service.
2. Gasket material:
 - a. Neoprene elastomer with minimum Shore A hardness value of 70.
 - b. Reinforcement: Inserted 13-ounce nylon fabric cloth for pipes 20-inch or larger.
 - c. Thickness: Minimum 3/32-inch thick for less than 10-inch pipe; minimum 1/8 inch thick for 10-inch and larger pipe.
3. Manufacturers: One of the following or equal:
 - a. Pipe less than 20 inches in diameter:
 - 1) Garlock, Style 7797.
 - 2) John Crane, similar product.

- b. Pipe 20 inches in diameter and larger:
 - 1) Garlock, Style 8798.
 - 2) John Crane, similar product.
- B. Gaskets for flanged joints in polyvinyl chloride and polyethylene piping:
 - 1. Suitable for pressures equal to or less than 150 pounds per square inch gauge, with low flange bolt loadings, temperatures equal and less than 120 degrees F, and polymer, chlorine, caustic solutions, and other chemicals, except chemicals which liberate free fluorine including fluorochemicals and gaseous fluorine.
 - 2. Material: 0.125-inch thick Viton® rubber.
 - 3. Manufacturers: One of the following or equal:
 - a. Garlock.
 - b. John Crane, similar product.
- C. Gaskets for flanged joints in ductile iron or steel water piping:
 - 1. Suitable for hot or cold water, pressures equal to or less than 150 pounds per square inch gauge, and temperatures equal to or less than 160 degrees F.
 - 2. Material:
 - a. Neoprene elastomer, compressed, with non-asbestos fiber reinforcement.
 - b. Teflon® ring; or Teflon® envelope with non-asbestos filler.
 - 3. Manufacturers: One of the following or equal:
 - a. Garlock, Bluegard 3300.
 - b. John Crane, similar product.
- D. Provide gaskets suitable for the specific fluids and pressure and temperature conditions.

2.03 LEAD-FREE MATERIALS

- A. Pipe, pipe or plumbing fittings or fixtures, solder, or flux used to convey water for human consumption shall be lead-free as defined in Section 116875 of the Health and Safety Code.
- B. Lead-free materials in accordance with amended provisions of the Health and Safety Code shall be used on this Project.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verification of existing conditions:
 - 1. Locate and expose existing structures, piping, conduits, and other facilities and obstructions that may affect construction of underground piping before starting excavation for new underground piping and appurtenances.
 - 2. Verify sizes, elevations, locations, and other relevant features of existing facilities and obstructions. Determine conflicts for the construction of the new underground piping and appurtenances.
 - 3. Make piping location and grade adjustments to resolve conflicts between new piping and existing facilities and obstructions.

3.02 INSTALLATION

A. General:

1. Piping drawings:
 - a. Except in details, piping is indicated diagrammatically. Not every offset and fitting, or structural difficulty that may be encountered has been indicated on the Drawings. Sizes and locations are indicated on the Drawings.
 - b. Perform minor modifications to piping alignment where necessary to avoid structural, mechanical, or other type of obstructions that cannot be removed or changed.
 - 1) Modifications are intended to be of minor scope, not involving a change to the design concept or a change to the Contract Price or Contract Times.
2. Piping alternatives:
 - a. Provide piping as specified in this Section, unless indicated on the Drawings or specified otherwise.
 - b. Alternative pipe ratings: Piping with greater pressure rating than specified may be substituted in lieu of specified piping without changes to the Contract Price. Piping of different material may not be substituted in lieu of specified piping.
 - c. Valves in piping sections: Capable of withstanding specified test pressures for piping sections and fabricated with ends to fit piping.
 - d. For flanged joints, where 1 of the joining flanges is raised face type, provide a matching raised face type flange for the other joining flange.
3. Unless otherwise indicated on the Drawings, piping at pipe joints, fittings, couplings, and equipment shall be installed without rotation, angular deflection, vertical offset, or horizontal offset.

B. Wall and slab penetrations:

1. Provide sleeves for piping penetrations through aboveground masonry and concrete walls, floors, ceilings, roofs, unless specified or otherwise indicated on the Drawings.
2. For piping 1 inch in nominal diameter and larger, provide sleeves with minimum inside diameters of 1 inch plus outside diameter of piping. For piping smaller than 1 inch in nominal diameter, provide sleeve of minimum twice the outside diameter of piping.
 - a. Arrange sleeves and adjacent joints so piping can be pulled out of sleeves and replaced without disturbing the structure.
 - b. Cut ends of sleeves flush with surfaces of concrete, masonry, or plaster.
 - c. Conceal ends of sleeves with escutcheons where piping runs through floors, walls, or ceilings of finished spaces within buildings.
 - d. Seal spaces between pipes and sleeves with link-type seals when not otherwise specified or indicated on the Drawings.
 - e. Seal openings around piping running through interior walls and floors of chlorine rooms and chlorine storage rooms gastight with synthetic rubber sealing compound.
3. Provide flexibility in piping connecting to structures to accommodate movement due to soil settlement and earthquakes. Provide flexibility using details indicated on the Drawings.

C. Exposed piping:

1. Install exposed piping in straight runs parallel to the axes of structures, unless otherwise indicated on the Drawings:
 - a. Install piping runs plumb and level, unless otherwise indicated on the Drawings. Slope plumbing drain piping with a minimum of 1/4 inch per foot downward in the direction of flow. Slope digester gas piping to drip traps or low-point drains at a minimum of 1/2 inch per foot where condensate flows against the gas, or at a minimum of 1/4 inch per foot where condensate flows with gas.
2. Install exposed piping after installing equipment and after piping and fitting locations have been determined.
3. Support piping: As specified in Sections 15061, 15062, and 15063:
 - a. Do not transfer pipe loads and strain to equipment.
4. In addition to the joints indicated on the Drawings, provide unions, flexible couplings, flanged joints, flanged coupling adapters, and other types of joints or means which are compatible with and suitable for the piping system, and necessary to allow ready assembly and disassembly of the piping.
5. Assemble piping without distortion or stresses caused by misalignment:
 - a. Match and properly orient flanges, unions, flexible couplings, and other connections.
 - b. Do not subject piping to bending or other undue stresses when fitting piping. Do not correct defective orientation or alignment by distorting flanged joints or subjecting flange bolts to bending or other undue stresses.
 - c. Flange bolts, union halves, flexible connectors, and other connection elements shall slip freely into place.
 - d. Alter piping assembly to fit, when proper fit is not obtained.
 - e. Install eccentric reducers or increasers with the top horizontal for pump suction piping.

D. Buried piping:

1. Bury piping with minimum 3-foot cover without air traps, unless otherwise indicated on the Drawings.
2. Where 2 similar services run parallel to each other, piping for such services may be laid in the same trench. Lay piping with sufficient room for assembly and disassembly of joints, for thrust blocks, for other structures, and to meet separation requirements of public health authorities having jurisdiction.
3. Laying piping:
 - a. Lay piping in finished trenches free from water or debris. Begin at the lowest point with bell ends up slope.
 - b. Place piping with top or bottom markings with markings in proper position.
 - c. Lay piping on an unyielding foundation with uniform bearing under the full length of barrels.
 - d. Where joints require external grouting, banding, or pointing, provide space under and immediately in front of the bell end of each section laid with sufficient shape and size for grouting, banding, or pointing of joints.
 - e. At the end of each day's construction, plug open ends of piping temporarily to prevent entrance of debris or animals.
4. Plastic tape wrap application procedures shall be in accordance with manufacturer's published instructions.
 - a. Apply primer with brush, without runs and drips.

- b. Lap wrapping not less than 1/2 inch. A single wrap lapped 50 percent or more will not be acceptable.
- c. Application on Welded Joints:
 - 1) Remove sharp edges of weld spatter and slag with file or ball peen hammer before wrapping welded joints.
 - 2) Apply a single thickness of tape base wrap over the primer, around the weld.
 - 3) Start first wrapping 4 inches back on the on the pipe wrap, spiral wrap tape over the joint holding the proper tension and overlap, and finish 4 inches back on the pipe wrap on the other side of the joint.
 - 4) Apply final wrapping in the same manner.
- d. Wrap fittings, valves, and other odd-shaped components in the pipeline with first and finish wrapping over the prime coat.
- e. Wrap fittings, valves, and other irregular shapes of piping with extruded coatings with tape as specified in this Subparagraph.

E. Restraining piping:

- 1. Restrain piping at valves and at fittings where piping changes direction, changes sizes, and at ends:
 - a. When piping is underground, use concrete thrust block or mechanical restraints as approved or indicated on the Drawings.
 - b. When piping is aboveground or underwater, use mechanical or structural restraints.
 - c. Determine thrust forces by multiplying the nominal cross sectional area of the piping by design test pressure of the piping.
- 2. Provide restraints with ample size to withstand thrust forces resulting from test pressures:
 - a. During testing, provide suitable temporary restraints where piping does not require permanent restraints.
- 3. Place concrete thrust blocks against undisturbed soil. Place concrete so piping joints, fittings, and other appurtenances are accessible for assembly and disassembly.
- 4. Provide underground mechanical restraints where specified in the Piping Schedule.

F. Connections to existing piping:

- 1. Expose existing piping to which connections are to be made with sufficient time to permit, where necessary, field adjustments in line, grade, or fittings:
 - a. Protect domestic water/potable water supplies from contamination:
 - 1) Make connections between domestic water supply and other water systems in accordance with requirements of public health authorities.
 - 2) Provide devices approved by OWNER of domestic water supply system to prevent flow from other sources into the domestic supply system.
- 2. Make connections to existing piping and valves after sections of new piping to be connected have been tested and found satisfactory.
- 3. Provide sleeves, flanges, nipples, couplings, adapters, and other fittings needed to install or attach new fittings to existing piping and to make connections to existing piping.
- 4. For flanged connections, provide stainless steel bolts with isolation bushings and washers, and full-face flange gaskets.

- G. Connections to in-service piping:
 - 1. Shutdown in-service piping as specified in Section 01140:
 - a. Establish procedures and timing in a conference attended by CONTRACTOR, CM, ENGINEER, and owner of the in-service piping.
 - 2. Where operation and maintenance of existing facilities require that a shutdown be made during hours other than normal working hours, perform the related work in coordination with the hours of actual shutdown.
 - 3. Additional provisions regarding shutdown of existing facilities are specified in Section 01140.
- H. Connections between ferrous and nonferrous metals:
 - 1. Connect ferrous and nonferrous metal piping, tubing, and fittings with dielectric couplings especially designed for the prevention of chemical reactions between dissimilar metals.
 - 2. Nonferrous metals include aluminum, copper, and copper alloys.
- I. Flanged connections between dissimilar metals such as ductile iron pipe and steel pipe:
 - 1. Provide stainless steel bolts with isolation bushings and washers, and full-face flange gaskets.

3.03 CLEANING

- A. Piping cleaning:
 - 1. Upon completion of installation, clean piping interior of foreign matter and debris. Perform special cleaning when required by the Contract Documents.
- B. Cleaning potable water piping:
 - 1. Flush and disinfect potable water piping as specified in Section 01757.

3.04 PIPING SCHEDULE

- A. Abbreviations:
 - 1. Test method abbreviations:

AM	Air method
HH	High head method
LH	Low head method
SC	Special case
 - 2. Pipe material abbreviations:

DIP	Ductile iron piping
GSP	Galvanized steel pipe
HDPE	High density polyethylene
PVC	Polyvinyl chloride
Sch.	Schedule, followed by the designation
SST	Stainless steel

- 3. Pipe lining abbreviations:
 - CM Cement mortar
 - EC Epoxy-ceramic
- 4. Pipe coating abbreviations:
 - CM Cement mortar
 - EC Epoxy-ceramic
 - EPU Epoxy polyurethane
 - HTC High temperature coating
 - PB Double Polyethylene bag
 - PTW Plastic tape wrap
- 5. Pipe service abbreviations:
 - D Drain
 - EPL Effluent Pipeline
 - V Vent
- 6. Other Useful Abbreviations:
 - < Less Than
 - > Greater Than

(The PIPING SCHEDULE follows on the next page.)

PIPING SCHEDULE								
Pipe Service	Abbrev.	Nominal Diameter (inches)	Piping	Joints/Fittings	Lining	Protective Coating	Test Pressure/ Method	Remarks
Effluent Pipeline								
Buried	EPL	Larger than 12-inch	AWWA C-905; PVC DR21 ⁽¹⁾	Rubber gaskets, Restrained where indicated. Fittings DIP ⁽⁵⁾	None	None	150 psig HH	
Buried	EPL	4-inch through 18-inch	DIP Class 51, Min	Restrained push-on joint	CM	PB	150 psig HH	
Buried	EPL	3-inch and Smaller	Schedule 40, Galvanized Steel, ASTM A 53	Screwed	None	PTW ⁽²⁾	150 psig HH	
Aboveground	EPL	All	DIP Class 53	As shown	CM	EPU	150 psig HH	
Tunneled or Drilled	EPL	All	HDPE DR11, Max ⁽¹⁾	Butt fused	None	None	150 psig HH	(3)
Vent	V	All	Schedule 40, Galvanized Steel	Screwed or welded	None	Exposed-EPU ⁽²⁾ Buried-PTW	-	(4)
Notes: (1) DR Values are at maximum. Use lower DR values where shown, specified, or required by calculation or field conditions. (2) Coat with PTW to 6 inches aboveground when buried. (3) Minimum ID: 20 inches. (4) Test with EPL if section of vent is to be pressurized. (5) AWWA C110.								

END OF SECTION

SECTION 15110

VALVES

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes: Basic requirements for valves.
- B. Related sections:
 - 1. The Contract Documents are complementary; what is called for by one is as binding as if called for by all.
 - 2. It is the CONTRACTOR's responsibility for scheduling and coordinating the Work of subcontractors, suppliers, and other individuals or entities performing or furnishing any of CONTRACTOR's Work.
 - 3. The following Sections are related to the Work described in this Section. This list of Related Sections is provided for convenience only and is not intended to excuse or otherwise diminish the duty of the CONTRACTOR to see that the completed Work complies accurately with the Contract Documents.
 - a. Section 01330 - Submittal Procedures.
 - b. Section 09960B - Coatings.
 - c. Section 15251 - Ductile Iron AWWA C151 Pipe.

1.02 REFERENCES

- A. American Water Works Association (AWWA):
 - 1. C111/A21.11 - Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe Fittings.
- B. ASTM International (ASTM):
 - 1. A 126 - Standard Specification for Gray Iron Casting for Valves, Flanges, and Pipe Fittings.
 - 2. A 167 - Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
 - 3. A 536 - Standard Specification for Ductile Iron Castings.
- C. NSF International (NSF):
 - 1. 61 - Drinking Water System Components - Health Effects.
- D. Society for Protective Coatings (SSPC):
 - 1. SP 7 - Brush-Off Blast Cleaning.
 - 2. SP 10 - Near-White Blast Cleaning.

1.03 DESIGN REQUIREMENTS

- A. Pressure rating:
 - 1. Suitable for service under minimum working pressures of 150 pounds per square inch gauge.
 - 2. When a piping system is specified in the Piping Schedule to be tested at a pressure greater than 150 pounds per square inch gauge, provide valves for

that piping system with design working pressure which is sufficient to withstand the test pressure.

- B. Valve to piping connections:
 - 1. Valves 3 inches nominal size and larger: Flanged ends.
 - 2. Valves less than 3 inches nominal size: Screwed ends.
 - 3. Plastic valves in plastic piping:
 - a. Up to 2.5 inches: Provide solvent or heat welded unions.
 - b. 3 inches and above: Provide solvent or heat welded flanges.

1.04 SUBMITTALS

- A. Submit as specified in Section 01330.
- B. Product data:
 - 1. Submit the following information for each valve:
 - a. Valve type, size, pressure rating, Cv factor.
 - b. Coatings.
 - c. Manual valve actuators:
 - 1) Information on valve actuator including size, manufacturer, model number.
 - d. Certified drawings with description of component parts, dimensions, weights, and materials of construction.
 - e. Certifications of reference standard compliance:
 - 1) Submit certification that the valves and coatings are suitable in potable water applications in accordance with NSF 61.
 - f. Clearly mark submittal information to show specific items, materials, and accessories or options being furnished.
 - g. Factory test data.
- C. Operation and maintenance data:
 - 1. Furnish bound sets of installation, operation, and maintenance instructions for each type of manual valve 4 inch in nominal size and larger, and all non-manual valves. Include information on valve operators in operation and maintenance instruction manual.

1.05 QUALITY ASSURANCE

- A. Manufacturer qualifications:
 - 1. Valves manufactured by manufacturers whose valves have had successful operational experience in comparable service.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Protect valves and protective coatings from damage during handling and installation; repair coating where damaged.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Stainless steel: In accordance with ASTM A 167, Type 316, or Type 304, UNS Alloy S31600 or S30400.
- B. Valve and operator bolts and nuts:
 - 1. Fabricated of stainless steel for the following installation conditions:
 - a. Submerged in sewage or water.
 - b. In an enclosed space above sewage or water.
 - c. In structures containing sewage or water, below top of walls.
 - d. At openings in concrete or metal decks.
 - 2. Where dissimilar metals are being bolted, use stainless steel bolts with isolation bushings and washers.
 - 3. Underground bolts: Low-alloy steel in accordance with AWWA C111/A21.11 or stainless steel where specified.
- C. Bronze and brass alloys: Use bronze and brass alloys with not more than 6 percent zinc and not more than 2 percent aluminum in the manufacture of valve parts; UNS Alloy C83600 or C92200 unless specified otherwise.
- D. Valve bodies: Cast iron in accordance with ASTM A 126, Class 30 minimum or ductile iron in accordance with ASTM A 536, Grade 65-45-12 minimum unless specified otherwise.

2.02 INTERIOR PROTECTIVE LINING

- A. When specified in the particular valve specification, provide valves with type of protective lining specified in the particular valve specification.
- B. Apply protective lining to interior, non-working surfaces, except stainless steel surfaces.
- C. Lining types:
 - 1. Fusion bonded epoxy:
 - a. Manufacturers: One of the following or equal:
 - 1) 3-M Company, ScotchKote 134; certified to NSF 61 for drinking water use.
 - b. Clean surfaces in accordance with SSPC SP 7 or SP 10, as recommended by epoxy manufacturer.
 - c. Apply in accordance with manufacturer's published instructions.
 - d. Lining thickness: 0.010 to 0.012 inch except that:
 - 1) Lining thickness in grooves for gaskets: 0.005 inch.
 - 2) Do not coat seat grooves in valves with bonded seat.
 - e. Quality control:
 - 1) Lining thickness: Measured with a non-destructive magnetic type thickness gauge.
 - 2) Verify lining integrity with a wet sponge-testing unit operating at approximately 60 volts, or as recommended by the lining manufacturer.
 - 3) Consider tests successful when lining thickness meets specified requirements and when no pinholes are found.

- 4) Correct defective lining disclosed by unsuccessful tests, and repeat test.
- 5) Repair pinholes with liquid epoxy recommended by manufacturer of the epoxy used for lining.
2. High solids epoxy:
 - a. Product equivalent to high solids epoxy specified in Section 09960B.
 - 1) Certified in accordance with NSF 61 for drinking water use.
 - 2) Interior: Coat valve interior with manufacturer's equivalent high performance high solids epoxy coating system with a certifiable performance history for the service conditions and as approved by the ENGINEER. Manufacturer shall provide for approval, coating information sufficient to allow ENGINEER to assess equivalence to the specified high solids epoxy coating specified in Section 09960B.
 - b. Clean surfaces to meet SP-7 or SP-10, or as recommended by coating manufacturer.
 - c. Quality control: After coating is cured, check coated surface for porosity with a holiday detector set at 1,800 volts, or as recommended by coating manufacturer.
 - 1) Repair holidays and other irregularities and retest coating.
 - 2) Repeat procedure until holidays and other irregularities are corrected.

2.03 UNDERGROUND VALVES

- A. Provide underground valves with flanged, mechanical, or other type of joint required for the type of pipe to which the valve is to be connected.
- B. Coating and wrapping:
 1. Prior to installation, coat buried valves with 2 coats of protective coal tar as specified in Section 09960B.
 2. After installation, encase valves in 2 layers of polyethylene wrap as specified for ductile iron piping in Section 15251.
 - a. Ascertain that polyethylene wrapping does not affect operation of valve.

2.04 VALVE BOXES

- A. Provide cast-iron valve boxes at each buried valve to access valve and valve operators.
- B. Do not support boxes on valve, valve operator, or pipe.
- C. Boxes:
 1. 2-piece, fabricated of cast iron; provide cover, with asphalt varnish or enamel protective coating.
 2. Adjustable to grade, install centered around the upper portions of the valve and valve operator.
 3. Cast the words "Recycled Water" on the lid.
- D. Manufacturers: One of the following or equal:
 1. Tyler Pipe Industries, Inc.
 2. Neenah Foundry Company.

2.05 VALVE OPERATORS

- A. Valve operator "Open" direction: Open counterclockwise.
- B. Provide valves located below operating level or deck with extensions for key operation or floor stands and handwheels.
- C. Provide manually operated valves located not more than 6 feet above the operating level with tee handles, wrenches, or handwheels.
 - 1. Make the valve operator more conveniently accessible by rolling valves, located more than 5 feet but less than 6 feet above the operating level, toward the operating side.
 - 2. Secure tee handles and wrenches to the valve head or stem, except where a handle or wrench so secured constitutes a hazard to personnel; in which case, stow handle or wrench immediately adjacent to the valve on or in a suitable hanger, bracket, or receptacle.
- D. Provide an operator shaft extension from valve or valve operator to finished grade or deck level when buried valves, and other valves located below the operating deck or level, are specified or indicated on the Drawings to be key operated; provide 2-inch square AWWA operating nut, and box and cover as specified, or a cover where a box is not required.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Preparation prior to installation:
 - 1. Install valves after the required submittal on installation has been accepted.
 - 2. Determine after flanged valves and flanged check valves are selected, the face-to-face dimensions of flanged valves and flanged check valves.
- B. Fabricate piping to lengths taking into account the dimensions of flanged valves and flanged check valves.

3.02 INSTALLATION

- A. Provide incidental work and materials necessary for installation of valves including flange gaskets, flange bolts and nuts, valve boxes and covers, concrete bases, blocking, and protective coating.
- B. Where needed, furnish and install additional valves for proper operation and maintenance of equipment and plant facilities under the following circumstances:
 - 1. Where such additional valves are required for operation and maintenance of the particular equipment furnished by CONTRACTOR.
 - 2. Where such additional valves are required as a result of a substitution or change initiated by CONTRACTOR.

- C. Install valves with their stems in vertical position above the pipe, except as follows:
 - 1. Butterfly valves, gate valves aboveground, globe valves, ball valves, and angle valves may be installed with their stems in the horizontal position.
 - 2. Install buried plug valves with geared operators with their stems in a horizontal position.
- D. Install valves so that handles clear obstructions when the valves are operated from fully open to fully closed.
- E. Place top of valve boxes flush with finished grade or as otherwise indicated on the Drawings.
- F. Valves with threaded connections:
 - 1. Install valves by applying wrench on end of valve nearest the joint to prevent distortion of the valve body.
 - 2. Apply pipe joint compound or Teflon[®] tape on external (male) threads to prevent forcing compound into valve seat area.
- G. Valves with flanged connections:
 - 1. Align flanges and gasket carefully before tightening flange bolts.
 - 2. When flanges are aligned, install bolts and hand tighten.
 - 3. Tighten nuts opposite each other with equal tension before moving to next pair of nuts.
- H. Valves with soldered connections:
 - 1. Do not overheat connection to prevent damage to resilient seats and metal seat rings.
 - 2. Position valves in full open position before starting soldering procedure.
 - 3. Apply heat to piping rather than to valve body.

END OF SECTION

SECTION 15112

BUTTERFLY VALVES

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes: Metal body butterfly valves.
- B. Related sections:
 - 1. The Contract Documents are complementary; what is called for by one is as binding as if called for by all.
 - 2. It is the CONTRACTOR's responsibility for scheduling and coordinating the Work of subcontractors, suppliers, and other individuals or entities performing or furnishing any of CONTRACTOR's Work.
 - 3. The following Sections are related to the Work described in this Section. This list of Related Sections is provided for convenience only and is not intended to excuse or otherwise diminish the duty of the CONTRACTOR to see that the completed Work complies accurately with the Contract Documents.
 - a. Section 01330 - Submittal Procedures.
 - b. Section 09960B - Coatings.
 - c. Section 13446 - Valve and Gate Operators.
 - d. Section 15110 - Valves.
 - e. Section 15251 - Ductile Iron AWWA C151 Pipe.

1.02 REFERENCES

- A. American Society of Mechanical Engineers (ASME):
 - 1. B16.1 - Cast Iron Pipe Flanges and Flanged Fittings, Classes 25, 125, and 250.
 - 2. B16.5 - Pipe Flanges and Flanged Fittings, NPS 1/2 through NPS 24.
- B. American Water Works Association (AWWA):
 - 1. C110 - Standard for Ductile-Iron and Gray-Iron Fittings.
 - 2. C504 - Rubber-Seated Butterfly Valves.
 - 3. C540 - Standard for Power-Actuating Devices for Valves and Sluice Gates.
 - 4. C550 - Protective Interior Coatings for Valves & Hydrants.
 - 5. C606 - Standard for Grooved and Shouldered Joints.
- C. ASTM International (ASTM):
 - 1. A 126 - Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.
 - 2. A 216 - Standard Specification for Steel Castings, Carbon, Suitable for Fusion Welding, for Higher-Temperature Service.
 - 3. A 276 - Standard Specification for Stainless Steel Bars and Shapes.
 - 4. A 351 - Standard Specification for Castings, Austenitic, for Pressure-Containing Parts.
 - 5. A 395 - Standard Specification for Ferritic Ductile Iron Pressure-Retaining Castings for Use at Elevated Temperatures.

6. A 479 - Standard Specification for Stainless Steel Bars and Shapes for Use in Boilers and Other Pressure Vessels.
 7. A 515 - Standard Specification for Pressure Vessel Plates, Carbon Steel, for Intermediate - and Higher-Temperature Service.
 8. A 516 - Standard Specification for Pressure Vessel Plates, Carbon Steel, for Moderate - and Lower-Temperature Service.
 9. A 536 - Standard Specification for Ductile Iron Castings.
 10. A 564 - Standard Specification for Hot-Rolled and Cold-Finished Age-Hardening Stainless Steel Bars and Shapes.
 11. B 584 - Standard Specification for Copper Alloy Sand Castings for General Applications.
 12. D 429 - Standard Test Methods for Rubber Property-Adhesion to Rigid Substrate.
- D. Compressed Gas Association (CGA):
1. Standard G-4.1 - Cleaning Equipment for Oxygen Service.
- E. NSF International (NSF):
1. Standard 61 - Drinking Water System Components - Health Effects.

1.03 SYSTEM DESCRIPTION

- A. Design requirements:
1. General purpose AWWA butterfly valves:
 - a. Design standard: Provide valves designed and manufactured in accordance with AWWA C504.
 - b. Class:
 - 1) Provide butterfly valves in accordance with AWWA Class 150B, unless otherwise specified.
 - 2) Provide butterfly valves in accordance with AWWA Class 250B in piping systems with test pressure greater than 150 pounds per square inch and less than 250 pounds per square inch.
 2. High pressure butterfly valves:
 - a. Piping systems designed for operating pressures greater than 250 pounds per square inch and less than 450 pounds per square inch: Provide ASME B16.5, Class 300 high pressure valves.
- B. Usage:
1. Provide and install butterfly valve types as outlined in the Butterfly Valve Application Schedule at the end of this Section.
- C. Design requirements for all butterfly valves with power actuating devices:
1. Design valves and actuators for maximum operating torque, in accordance with and using safety factors required in AWWA C540, using the following values:
 - a. Maximum water velocity: 16 feet per second with valve fully open.
 - b. Maximum pressure differential across the closed valve equal to the pressure class designation.
 - c. Coefficient for seating and unseating torque, dynamic torque, and bearing friction in accordance with valve manufacturer's published recommendations.

2. Valve disc: Seat in an angular position of 90 degrees to the pipe axis and rotate an angle of 90 degrees between fully open and fully closed positions:
 - a. Do not supply valves with stops or lugs cast with or mechanically secured to the body of the valve for limiting the disc travel.
 3. Unacceptable thrust bearings: Do not provide valves with thrust bearings exposed to the fluid in the line and consisting of a metal bearing surface in rubbing contact with an opposing metal bearing surface.
- D. Performance requirements:
1. Tight shutoff at the pressure rating of the valve with pressure applied in either direction.
 2. Suitable for the following service conditions:
 - a. Throttling.
 - b. Frequent operation.
 - c. Operation after long periods of inactivity.
 - d. Installation in any position and flow in either direction.

1.04 SUBMITTALS

- A. Shop drawings: Submit the following information as specified in Section 01330 and Section 15110:
1. Product data:
 - a. For general purpose AWWA butterfly valves, include description of the method of attachment of the disc edge to the valve disc.
 2. Certificates:
 - a. General purpose AWWA butterfly valves:
 - 1) Proof-of-design tests: Certified statement that proof-of-design tests were performed and all requirements were successfully met.
 - 2) Affidavit of compliance attesting valves provided comply with all provisions in accordance with AWWA C504.
 - b. Interior epoxy coatings: Affidavit of compliance attesting that epoxy coatings applied to interior surfaces of butterfly valves comply with all provisions in accordance with AWWA C550.
 - c. Certification, for all valves and coatings in contact with potable water, that the products used are suitable for contact with drinking water in accordance with NSF Standard 61.
 3. Operation and Maintenance Data.

PART 2 PRODUCTS

2.01 GENERAL PURPOSE AWWA BUTTERFLY VALVES

- A. Manufacturers: One of the following or equal:
1. DeZurik/Sartell Model BAW.
 2. Henry Pratt Company.
- B. Valve body:
1. Material: Cast iron, ASTM A 126, Grade B, or ductile iron, ASTM A 536, Grade 65-45-12.

2. Body design:
 - a. Flanged body valves:
 - 1) Usage: Comply with limitations specified in the Butterfly Valve Application Schedule.
 - 2) Flanges: In accordance with ASME B16.1 Class 125 flanges for Class 150B valves, in accordance with ASME B16.1 Class 250 flanges for Class 250B valves.
 - b. Mechanical joint body valves:
 - 1) Usage: Comply with limitations specified in the Butterfly Valve Application Schedule.
 - 2) Mechanical joint design: In accordance with AWWA C110.
 - 3) When mechanical joint body valves are used, incorporate valve into thrust restraint analysis as specified in Section 15251. Utilize test pressure on one side of valve and zero pressure on the opposite side of the valve. Restrain pipe joints on both sides of valve as determined by thrust analysis calculations.
 - c. Wafer and lugged body valves: Not acceptable.
- C. Disc:
 1. Material: Cast iron or ductile iron with Type 316 stainless steel edge that matches seat in valve body.
 2. Secure valve disc to shaft by means of smooth-sided, taper or dowel pins, Type 316 stainless steel, or Monel.
 3. Extend pins through full diameter of shaft and mechanically secure in place.
- D. Shaft and bearings:
 1. Shaft design:
 - a. Valves 20-inch and less: 1 piece, through disc design.
 - b. Valves greater than 20-inch size: 2 piece, stub shaft design.
 2. Shaft seal: Vee type, chevron design.
 3. Shaft material for Class 150B valves: Type 316 stainless steel, ASTM A 276.
 4. Shaft material for Class 250B valves: Type 17-4 pH stainless steel, ASTM A 564.
 5. Shaft bearings: Self-lubricating sleeve type:
 - a. Valves 20-inch and less: Nylatron.
 - b. Valves greater than 20-inch size: Teflon[®] with stainless steel or fiberglass backing.
- E. Seats:
 1. Seat materials:
 - a. In all applications: EPDM.
 2. For valves 20 inches in nominal size and smaller, bond or vulcanize seat into the valve body.
 3. For valves 24 inches in nominal size and larger, retain seats mechanically or by adhesive:
 - a. Mechanical retainage: Retain seat by a clamping ring with segmented clamping ring locks with adjusting locking screws.
 - 1) Clamping ring, ring locks, and adjusting locking screws: Type 316 stainless steel.
 - 2) Provide means to prevent ring locks and screws used to retain seats from loosening due to vibration or cavitation.

- b. Adhesive retainage: Inset the seat within a groove in the valve body and retain in place with epoxy injected behind the seat so that the seat expands into the body.
- c. Do not provide valves with seats retained by snap rings or spring-loaded retainer rings.
- 4. Resilient seat: Withstand 75 pound per inch pull when tested in accordance with ASTM D 429, Method B.

F. Valve packing:

- 1. Valves 4-inch to 48-inch nominal size: Self-adjusting V-type packing or chevron-type packing: EPDM.

2.02 BUTTERFLY VALVE ACTUATORS

- A. Manual actuators for aboveground valves, 4 inches in nominal size and smaller for liquid service.
 - 1. For valves operating at pressures up to and including 250 pounds per square inch, provide hand lever type with locking device so that the valve can be locked in any position with a wing nut.
 - a. Locking device: Rigid, allowing no vibration or chattering of the valve.
 - b. Hand lever: 12 inches long, with handgrip.
 - 2. For valves operating at pressures above 250 pounds per square inch, provide totally enclosed worm gear actuator mounted on the valve.
- B. Manual actuators for aboveground valves in nominal sizes and in service applications other than specified above, except for valves 30 inches and larger.
 - 1. For valves operating at pressures up to and including 250 pounds per square inch, provide either a totally enclosed worm gear actuator or a totally enclosed traveling nut actuator mounted on the valve.
 - 2. For valves operating at pressures above 250 pounds per square inch, provide totally enclosed worm gear actuator mounted on the valve.
- C. Manual actuators for buried or submerged valves, all sizes, and pressures.
 - 1. Provide totally enclosed worm gear actuator mounted on the valve.
 - 2. Actuators for buried or submerged valves: Hermetically sealed and grease packed.
 - 3. For buried valves, provide 2-inch square AWWA nut on enclosed actuator.
 - 4. For buried valves, provide extension stem, valve box, and valve box cover as specified in Section 15110.
 - 5. For submerged valves, provide extension stem as indicated on the Drawings.
- D. Position indication:
 - 1. For all aboveground worm gear or traveling nut manual actuators, provide position indication on the actuator enclosure.

2.03 COATING

- A. Shop coat interior and exterior metal surfaces of valves, except as follows:
 - 1. Interior machined surfaces.
 - 2. Surfaces of gaskets and elastomeric seats and stem seals.
 - 3. Bearing surfaces.
 - 4. Stainless steel surfaces and components.

- B. Coating material for potable water applications:
 - 1. Formulate coating material from materials in accordance with the Food and Drug Administration, Title 21 of the Code of Federal Regulations on Food Additives.
- C. Field applied coatings:
 - 1. Additional coating of the valve exterior will be required to match the epoxy or epoxy/polyurethane paint system as specified in Section 09960B.
 - a. When shop applied finish coating matches field applied coating on adjacent piping, touch up shop coating in damaged areas in accordance with instructions recommended by the paint manufacturer.
 - b. When shop applied coating does not match field coating on adjacent piping, or when damage has occurred to the shop applied coating that requires more than touchup, blast clean valve surfaces or utilize other surface preparation recommended by the manufacturer of the coating material and apply the coating system used for coating adjacent piping.
- D. Surface coatings:
 - 1. Exterior surfaces of valves, actuators, and accessories:
 - a. Submerged valves: High solids epoxy.
 - b. Buried valves: Per Sections 15110 and 09960B.
 - c. Other valves: High solids epoxy with polyurethane topcoat.
 - 2. Polished and machined surfaces: Apply rust-preventive compound.
- E. Coating materials:
 - 1. High solids epoxy:
 - a. Products: As specified in Section 09960B:
 - 1) Coating product in contact with potable water must be in accordance with AWWA C550 and NSF 61.
 - 2. Rust-preventive compound: One of the following or equal:
 - a. Houghton, Rust Veto 344.
 - b. Rust-Oleum, R-9.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install valves with valve shafts horizontal, unless a vertical shaft is required to suit a particular installation, and unless a vertical shaft is indicated on the Drawings.
- B. Install pipe spools or valve spacers in locations where butterfly valve disc travel may be impaired by adjacent pipe lining, pipefittings, valves, or other equipment.

3.02 BUTTERFLY VALVE APPLICATION SCHEDULE

- A. Acceptable butterfly valve types and body styles are listed in the Butterfly Valve Application Schedule provided at the end of this Section. Furnish and install butterfly valves in accordance with this Schedule.

BUTTERFLY VALVE APPLICATION SCHEDULE	
Valve Type and Style	Acceptable Applications
General Purpose AWWA Butterfly Valves – Flanged Body Design	<p>Aboveground or submerged in the following service applications only:</p> <ul style="list-style-type: none"> - Acceptable in all service applications except high-pressure service. - May be used in buried applications when required by the specified piping system.
General Purpose AWWA Butterfly Valves – Mechanical Joint Body Design	<p>Buried only where indicated on the Drawings:</p> <ul style="list-style-type: none"> - Acceptable in all service applications except oxygen and ozone service and high-pressure service.
General Purpose AWWA Butterfly Valves – Lugged Body Design	Not allowed.
General Purpose AWWA Butterfly Valves – Wafer (not lugged) Body Design	Not allowed.
General Purpose AWWA Butterfly Valves – Grooved End Body Design	Not allowed.
High Pressure Butterfly Valves – Flanged Body Design	Service applications with piping system test pressure greater than 250 psi. Acceptable in aboveground and buried installations.
Industrial Class Butterfly Valves – Wafer (not lugged) Body Design	Not allowed.

END OF SECTION

SECTION 15115

GATE, GLOBE, AND ANGLE VALVES

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes: Gate, globe, angle, plug disc and plain hose valves, and yard hydrants.
- B. Related sections:
 - 1. The Contract Documents are complementary; what is called for by one is as binding as if called for by all.
 - 2. It is the CONTRACTOR's responsibility for scheduling and coordinating the Work of subcontractors, suppliers, and other individuals or entities performing or furnishing any of CONTRACTOR's Work.
 - 3. The following Sections are related to the Work described in this Section. This list of Related Sections is provided for convenience only and is not intended to excuse or otherwise diminish the duty of the CONTRACTOR to see that the completed Work complies accurately with the Contract Documents.
 - a. Section 01330 - Submittal Procedures.
 - b. Section 15110 - Valves.

1.02 REFERENCES

- A. American Society of Mechanical Engineers (AMSE).
- B. American Water Works Association (AWWA):
 - 1. C 509 - Resilient-Seated Gate Valves for Water Supply Service (Includes Addendum C509a-95).
 - 2. C515 - Standard for Reduced-Wall, Resilient-Seated Gate Valves for Water Supply Services.
 - 3. C 550 - Protective Interior Coatings for Valves and Hydrants.
- C. ASTM International (ASTM):
 - 1. B 98 - Standard Specification for Copper-Silicon Alloy Rod, Bar, and Shapes.

1.03 SUBMITTALS

- A. Shop drawings: Submit the following information as specified in Sections 01330 and 15110:
 - 1. Product Data.
 - 2. Certificates:
 - a. General purpose AWWA gate valves:
 - 1) Proof-of-Design Tests: Certified statement that proof-of-design tests were performed and all requirements were successfully met.
 - 2) Affidavit of compliance attesting valves provided in accordance with all provisions of AWWA C515.

- b. Interior epoxy coatings: Affidavit of compliance attesting that epoxy coatings applied to interior surfaces of valves and hydrants comply in accordance with all provisions of AWWA C550.
- 3. Operation and Maintenance Data.

PART 2 PRODUCTS

2.01 GATE VALVES

- A. Gate valves aboveground:
 - 1. Valves less than 3 inches in size for clean water and air service: Manufacturer's standard bronze, solid wedge disc, rising stem, screwed end, Class 150 pounds:
 - a. Manufacturers: One of the following or equal:
 - 1) Crane, Figure 431.
 - 2) Jenkins, Figure 47.
 - 3) Lunkenheimer Company, Figure 2151.
 - 2. Valves 3 inches in size and larger:
 - a. Resilient wedge type in accordance with AWWA C515.
 - b. Flange, iron body, and bonnet rated for 200-pound working pressure. Provide O-ring seal between valve body and bonnet.
 - c. Ductile or cast iron wedge encapsulated in nitrile rubber and capable of sealing in either flow direction.
 - d. Bronze stem with double or triple O-ring or braided packing stem seals.
 - e. Rising stem configuration with handwheel diameter sized to allow opening of valve with no more than a 40-pound pull.
 - f. Coat interior and exterior surfaces of valve body and bonnet with fusion-bonded epoxy in accordance with AWWA C550.
 - g. Manufacturers: One of the following or equal:
 - 1) M&H/Kennedy Valve Company.
 - 2) Mueller.
 - 3) American Flow Control, Series 2500.
- B. Gate valves underground:
 - 1. Resilient wedge type in accordance with AWWA C515.
 - 2. Iron body, resilient seat, non-rising stem, double O-ring stem seal.
 - 3. Ductile or cast iron wedge encapsulated in nitrile rubber and capable of sealing in either flow direction.
 - 4. Bronze stem with double or triple O-ring or braided packing stem seals.
 - 5. Coat interior and exterior surfaces of valve body and bonnet with fusion-bonded epoxy in accordance with AWWA C550.
 - 6. Valve operator: Provide standard AWWA 2-inch operating nut, matching valve key, and valve box for operating stem.
 - 7. Manufacturers: One of the following or equal:
 - a. M&H/Kennedy Valve Company.
 - b. Mueller Company.
 - c. American Flow Control.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install valves as specified in Section 15110 and manufacturer's instructions.

END OF SECTION

SECTION 15118

PRESSURE REDUCING AND PRESSURE RELIEF VALVES

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes: Pressure reducing and pressure relief valves for water service.
- B. Related Sections:
 - 1. Section 01330 - Submittal Procedures.
 - 2. Section 15110 - Valves.

1.02 REFERENCES

- A. American Society for Testing and Materials (ASTM):
 - 1. A 48 - Specification for Gray Iron Castings.
 - 2. A 126 - Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.
 - 3. A 536 - Specification for Ductile Iron Castings.

1.03 SUBMITTALS

- A. Submit in accordance with Sections 01330, and 15110.
- B. Product Data: Detailed technical information relating to each type of valve including description of component parts, materials of construction, performance information, dimensions and weights.
- C. Operations and Maintenance Data: Furnish bound sets of installation, operation, and maintenance instructions for each type of valve.

PART 2 PRODUCTS

2.01 WATER PRESSURE REDUCING/SUSTAINING VALVES

- A. Pressure reducing valve shall be installed to hold a setpoint pressure on the EPL and reduce that pressure to the Camrosa Diversion pipeline. The setpoint pressure will maintain proper pump back pressure while bypassing flow to Camrosa's Diversion pipeline. The valve shall also reduce pressure flowing into the Camrosa pipeline and shall have a check feature preventing flow from Camrosa's pipeline back to Camarillo's system.
- B. Water Pressure Reducing Valves, 3 Inches and Larger:
 - 1. Manufacturers: One of the following, or equal:
 - a. Cla-Val Model 92.01.
 - 2. Design:
 - a. Pilot-controlled, hydraulically operated, diaphragm actuated, globe-patterned valve.

- b. Rated for 125 pounds per square inch gauge.
 - c. Pilot Line: Equipped with strainers.
 - d. Flanges: 150 pound rating, conforming to ANSI B16.42.
 - e. Pilot system shall be covered with 1-1/2-inch closed-cell insulation –K-factor not more the 0.27 Btu-inch/hr-sq.ft.-degrees F.
- 3. Materials:
 - a. Body and Cover: Cast iron ASTM A 48 or Ductile Iron ASTM A 536.
 - b. Valve Trim: Stainless Steel 316.
 - c. Pilot Control: Cast bronze with Series 303 stainless steel trim.
 - d. Diaphragm: Nylon reinforced Buna N or EPDM.
 - e. Lining: Fusion-bonded epoxy per Section 15110.
- 4. Initial Settings:
 - a. Upstream pressure: 20 psi.
 - b. Downstream pressure: 10 psi.
 - c. Maximum flow rate: 5,000 gpm.

2.02 WATER PRESSURE RELIEF VALVES

- A. Water Pressure Relief Valves:
 - 1. Manufacturers: One of the following, or equal:
 - a. Watts ACV Series 116.
 - b. Cla-Val Model 50-01.
 - 2. Design:
 - a. Pilot controlled, hydraulically operated, diaphragm actuated, globe patterned valve.
 - b. Rated for 125 pounds per square inch gauge.
 - c. Pilot Line: Equipped with a strainer.
 - d. End Connections:
 - 1) 2-1/2-inch and Smaller: Screwed.
 - 2) 3-inch and Larger: 150 pound rated flanges conforming to ANSI B16.42.
 - 3. Materials:
 - a. Body and Cover: Cast iron ASTM A 48 or Ductile Iron ASTM A 536.
 - b. Valve Trim: Type 316 Stainless Steel.
 - c. Pilot Control: Cast bronze with Series 303 stainless steel trim.
 - d. Diaphragm: Nylon reinforced Buna N, EPDM, or Neoprene.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in accordance with Section 15110.

END OF SECTION

SECTION 15119

AIR AND VACUUM RELIEF VALVES

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes: Air release valves, air and vacuum valves, and air vents.
- B. Related Sections:
 - 1. The Contract Documents are complementary; what is called for by one is as binding as if called for by all.
 - 2. It is the CONTRACTOR's responsibility for scheduling and coordinating the Work of subcontractors, suppliers, and other individuals or entities performing or furnishing any of CONTRACTOR's Work.
 - 3. The following Sections are related to the Work described in this Section. This list of Related Sections is provided for convenience only and is not intended to excuse or otherwise diminish the duty of the CONTRACTOR to see that the completed Work complies accurately with the Contract Documents.
 - a. Section 01330 - Submittal Procedures.
 - b. Section 15110 - Valves.

1.02 REFERENCES

- A. American Society of Mechanical Engineers (ASME).
 - 1. B16.1 - Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250.
 - 2. B16.5 Pipe Flanges and Flanged Fittings: NPS 1/2 through 24.
- B. American Water Works Association (AWWA).
- C. ASTM International (ASTM):
 - 1. A 126 - Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.
 - 2. A 240 - Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
 - 3. A 270 - Standard Specification for Seamless and Welded Austenitic Stainless Steel Sanitary Tubing.
 - 4. B 584 - Standard Specification for Copper Alloy Sand Castings for General Applications.

1.03 SUBMITTALS

- A. Shop Drawings: Submit the following information as specified in Sections 01330 and 15110:
 - 1. Product data.
 - 2. Operation and maintenance data.
 - 3. Manufacturer's recommended orifice and needle size and needle hardness.

PART 2 PRODUCTS

2.01 COMBINATION AIR VALVES - SEWAGE SERVICE

- A. Manufacturers: One of the following or equal:
 - 1. Valve and Primer Corporation, APCO Series 440.
 - 2. Multiplex Manufacturing Company, Crispin Series US.
- B. Design:
 - 1. Operation: Automatic exhaust and intake of large quantities of air during filling and draining of pipelines, respectively, and release of accumulated air while pipeline is under pressure.
 - 2. Design: Use compound lever system in conjunction with large and small orifices.
 - 3. Internal parts removable through top cover without removing valve from pipeline.
 - 4. Pressure rating: 150 pounds per square inch.
 - 5. Connections: Flanged unless otherwise indicated on the Drawings.
 - 6. Accessories:
 - a. Inlet shutoff valve.
 - b. 2 blowoff valves for backflushing.
 - c. 10 feet of hose with quick disconnect couplings.
- C. Materials:
 - 1. Body: Cast iron.
 - 2. Float: Type 316 stainless steel.
 - 3. Needle: EPDM or Viton®.

2.02 AIR AND VACUUM SLOW CLOSING VALVE

- A. Manufacturers: One of the following or equal:
 - 1. Valve and Primer Corporation, APCO, Series 1200 slow closing air and vacuum valve.
 - 2. Val-Matic, equivalent product.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install as specified in Section 15110 and manufacturer's instructions.
- B. Install air release valves and air and vacuum valves with suitable discharge lines to nearest drainage system.

END OF SECTION

SECTION 15120

PIPING SPECIALTIES

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes: Piping specialties including:
 - 1. Pipe saddles for ductile iron pipe.
 - 2. Tapping sleeves.
- B. Related Sections:
 - 1. The Contract Documents are complementary; what is called for by one is as binding as if called for by all.
 - 2. It is the CONTRACTOR's responsibility to schedule and coordinate Work of subcontractors, suppliers, and other individuals or entities performing or furnishing any of CONTRACTOR's Work.
 - 3. The following Sections are related to Work described in this Section. The list is provided for convenience only; it is not intended to excuse or otherwise diminish CONTRACTOR's duty to ensure the completed Work complies accurately with the Contract Documents.
 - a. Section 17402 - Pressure/Vacuum Measurement - Instrument Valves.

1.02 REFERENCES

- A. American Society of Mechanical Engineers (ASME):
 - 1. B16.5 - Pipe Flanges and Flanged Fittings.
- B. American Water Works Association (AWWA):
 - 1. C110 - Standard for Ductile-Iron and Gray-Iron Fittings.
 - 2. C151 - Standard for Ductile-Iron Pipe, Centrifugally Cast.
- C. ASTM International (ASTM):
 - 1. A 148 - Standard Specification for Steel Castings, High-Strength, for Structural Purposes.
 - 2. A 536 - Standard Specification for Ductile Iron Castings.

1.03 SUBMITTALS

- A. Product Data:
 - 1. Manufacturer's certificate attesting successful performance of specified tests.
 - 2. Shop drawings detailing dimensions and materials.
 - 3. Manufacturer's published installation instructions.
 - 4. Operation and maintenance manuals.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Bellows Type Expansion joints and Vibration Control Joints:
 - 1. Protect joints against damage during packing, shipping and installation, and also during pressure test.

2. Lock expansion joints against movement until pressure tests are completed.
3. Replace damaged expansion joints with new and undamaged expansion joints.

PART 2 PRODUCTS

2.01 PIPE SADDLES FOR DUCTILE IRON PIPE

- A. Manufacturers: One of the following or equal:
 1. BTR Inc./Smith-Blair, Inc., Style 317.
 2. Romac Industries, Inc., Style 202S.
- B. Materials:
 1. Pipe Saddles: Ductile iron.
 2. Straps, bolts, and nuts: Type 304 stainless steel with Teflon coating on nuts.
 3. Gaskets: EPDM.

2.02 TAPPING SLEEVES

- A. Manufacturers: One of the following or equal:
 1. BTR, Inc./Smith-Blair, Inc., Style 622.
 2. Romac Industries, Inc., Style FTS 420.
- B. Materials:
 1. Tapping sleeves: Steel construction.
 2. Bolts and nuts: Type 304 stainless steel.
 3. Nuts: Teflon coated.
 4. Gaskets: EPDM.
 5. Size of tapped boss: As indicated on the Drawings.

PART 3 EXECUTION

- A. Pipe Saddles:
 1. Coat threads on bolts with anti-gall coating prior to installation.
- B. Tapping Sleeves:
 1. Coat threads on bolts with anti-gall coating prior to installation.

END OF SECTION

SECTION 15121

PIPE COUPLINGS

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Dismantling joints.
 - 2. Flanged coupling adapters.
 - 3. Flexible couplings.
 - 4. Restrained flange coupling adapters.
 - 5. Restrained couplings.
- B. Related Sections:
 - 1. Section 09960B - Coatings.
 - 2. Section 15052 - Basic Piping Materials and Methods.

1.02 REFERENCES

- A. American Society for Testing and Materials (ASTM):
 - 1. A 36 - Standard Specification for Carbon Structural Steel.
 - 2. A 53 - Standard Specification for Pipe, Steel, Black and Hot-Dip, Zinc-Coated, Welded and Seamless.
 - 3. A 193 - Standard Specification for Alloy Steel and Stainless Steel Bolting Materials for High Temperature Service.
 - 4. A 536 - Standard Specification for Ductile Iron Castings.
 - 5. A 563 - Standard Specification for Carbon and Alloy Steel Nuts.
 - 6. A 576 - Standard Specification for Steel Bars, Carbon, Hot-Wrought, Special Quality.
 - 7. D 2000 - Standard Classification System for Rubber Products in Automotive Applications.
 - 8. F 593 - Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs.
- B. American Water Works Association (AWWA):
 - 1. C111 - AWWA Standard for Rubber Gasket Joints for Ductile Iron Pipe and Fittings.
 - 2. C207 - AWWA Standard for Steel Pipe Flanges for Waterworks Service - Sizes 4 Inches Through 144 Inches (100 mm through 3,600 mm).
- C. National Science Foundation (NSF).
 - 1. 61 - Drinking Water System Components - Health Effects.

1.03 SUBMITTALS

- A. Shop Drawings, detailing dimensions, and materials.

- B. Piping Layout Drawings: Coordinate preparation of required piping layout drawings such that coupling center sleeve sizes are clearly identified on drawings.
- C. Manufacturer's published installation instructions.

PART 2 PRODUCTS

2.01 PIPE COUPLINGS FOR DUCTILE IRON PIPING

- A. Dismantling Joints:
 - 1. Manufacturers: One of the following or equal:
 - a. Romac Industries, Inc., Style DJ400.
 - b. Smith-Blair, Inc., Series 975.
 - 2. Materials:
 - a. Flanged Spool:
 - 1) C207 Schedule 40 steel pipe in accordance with ASTM A 53 for sizes 3 inches to 12 inches.
 - 2) Steel for pipe in accordance with ASTM A 36 for sizes 14 inches to 72 inches.
 - b. End Ring and Body:
 - 1) For sizes 3 inches to 12 inches, ductile iron in accordance with ASTM A 536.
 - 2) For sizes 14 inches to 72 inches, steel in accordance with ASTM A 36 or A 53.
 - c. Follower Ring: Ductile iron in accordance with ASTM A 536 or steel in accordance with ASTM A 36 or A 576.
 - d. Bolts and Hex Nuts:
 - 1) Aboveground: High-strength, low-alloy steel in accordance with AWWA C111.
 - 2) Buried and Underwater: Type 316 stainless steel bolts in accordance with ASTM F 593.
 - e. Tie Rods: High-tensile steel in accordance with ASTM A 193 Grade B7.
 - 3. Flange Design: Class D steel ring flange in accordance with AWWA C207, compatible with ANSI Class 125 and 150 bolt circles.
 - 4. Coating and Lining: Manufacturer's standard fusion-bonded epoxy, NSF 61 certified.
- B. Flanged Coupling Adapters: 12 inch size and smaller.
 - 1. Manufacturers: One of the following or equal:
 - a. Dresser, Inc., Style 227.
 - b. Romac Industries, Inc., Style FCA501.
 - c. Smith-Blair, Inc., Series 912.
 - 2. Materials:
 - a. Flanged Body: Ductile iron in accordance with ASTM A 536.
 - b. Follower Ring: Ductile iron in accordance with ASTM A 536.
 - c. Bolts and Hex Nuts:
 - 1) Aboveground: High strength, low alloy steel in accordance with AWWA C111.
 - 2) Buried and Underwater: Type 316 stainless steel bolts in accordance with ASTM F 593.

3. Flange Design: Class D steel ring flange in accordance with AWWA C207 compatible with ANSI Class 125 and 150 bolt circles.
 4. Coating and Lining: Manufacturer's standard fusion bonded epoxy, NSF 61 certified.
- C. Flanged Coupling Adapters: Greater than 12 inch size:
1. Manufacturers: One of the following or equal:
 - a. Dresser, Inc., Style 128-W.
 - b. Romac Industries, Inc., Style FC400.
 - c. Smith-Blair, Inc., Series 913.
 2. Materials:
 - a. Flange and Flanged Body: Ductile iron or low carbon steel having a minimum yield strength of 30,000 pounds per square inch.
 - b. Follower Ring: Low carbon steel having a minimum yield strength of 30,000 pounds per square inch.
 - c. Bolts and Hex Nuts:
 - 1) Aboveground: High strength, low alloy steel in accordance with AWWA C111.
 - 2) Buried and Underwater: Type 316 stainless steel bolts in accordance with ASTM F 593.
 3. Flange Design: Class D steel ring flange in accordance with AWWA C207 compatible with ANSI Class 125 and 150 bolt circles.
 4. Coating and Lining: Manufacturer's standard fusion bonded epoxy, NSF 61 certified.
- D. Flexible Couplings:
1. Manufacturers: One of the following or equal:
 - a. Dresser, Inc., Style 253.
 - b. Romac Industries, Inc., Style 501.
 - c. Smith-Blair, Inc., Series 441.
 2. Materials:
 - a. Center Rings: Ductile iron in accordance with ASTM A 536.
 - b. Follower Rings: Ductile iron in accordance with ASTM A 536.
 - c. Bolts and Hex Nuts:
 - 1) Aboveground: High strength, low alloy steel in accordance with AWWA C111.
 - 2) Buried and Underwater: Type 316 stainless steel in accordance with ASTM F 593.
 3. Coating and Lining: Manufacturer's standard fusion bonded epoxy, NSF 61 certified.
 4. Center Sleeve Dimensions: Provide center sleeves with lengths in accordance with following table:

Nominal Pipe Size	Sleeve Length
3 inch and smaller	Manufacturer's standard
4 inch through 8 inch	7 inches
10 inch through 14 inch	12 inches
Greater than 16 inch	Use steel flexible coupling per Article 2.02

- E. Restrained Flange Coupling Adapter:
1. Manufacturers: One of the following or equal:
 - a. Romac Industries, Inc., Style RFCA.
 2. Materials:
 - a. Flange and Flanged Body: Ductile iron in accordance with ASTM A 536.
 - b. Follower Ring: Lug type restraint system.
 - 1) Follower Ring: Ductile iron in accordance with ASTM A 536.
 - 2) Restraining Lugs: Ductile iron in accordance with ASTM A 536.
 - a) Designed to contact the pipe and apply forces evenly.
 - 3) Restraining Bolts: Ductile iron in accordance with ASTM A 536. Bolt heads shall be designed to twist off when the proper torque has been applied.
 - c. Bolts and Hex Nuts:
 - 1) Aboveground: High strength, low alloy steel in accordance with AWWA C111.
 - 2) Buried and Underwater: Type 316 stainless steel bolts in accordance with ASTM F 593.
 3. Flange Design: Class D steel ring flange in accordance with AWWA C207 compatible with ANSI Class 125 and 150 bolt circles.
 4. Coating and Lining: Manufacturer's standard fusion bonded epoxy, NSF 61 certified.
 5. Angular Deflection: Restrained flange coupling adapter must allow angular deflection after assembly.

2.02 PIPE COUPLINGS FOR STEEL PIPING

- A. Dismantling Joints:
1. Manufacturers: One of the following or equal:
 - a. Romac Industries, Inc., Style DJ400.
 - b. Smith-Blair, Inc., Series 975.
 2. Materials:
 - a. Flanged Spool:
 - 1) C207 Schedule 40 pipe in accordance with ASTM A 53 for sizes 3 inches to 12 inches.
 - 2) Steel for pipe in accordance with ASTM A 36 or A 53 for sizes 14 inches to 72 inches.
 - b. End Ring and Body:
 - 1) For sizes 3 inches to 12 inches, ductile iron in accordance with ASTM A 536.
 - 2) For sizes 14 inches to 72 inches, steel in accordance with ASTM A 36.
 - c. Follower Ring: Ductile iron in accordance with ASTM A 536 or steel in accordance with ASTM A 36 or A 576.
 - d. Bolts and Hex Nuts:
 - 1) Aboveground: High strength, low alloy steel in accordance with AWWA C111.
 - 2) Buried and Underwater: Type 316 stainless steel bolts in accordance with ASTM F 593.
 - e. Tie Rods: High tensile steel in accordance with ASTM A 193 grade B7.
 3. Flange Design: Class D steel ring flange in accordance with AWWA C207 compatible with ANSI Class 125 and 150 bolt circles.
 4. Coating and Lining: Fusion-bonded epoxy certified in accordance with NSF 61.

- B. Flanged Coupling Adapters:
1. Manufacturers: One of the following or equal:
 - a. Dresser, Inc., Style 128-W.
 - b. Romac Industries, Inc., Style FCA501 (10 inch and smaller) or Style FC400 (12 inch and larger).
 - c. Smith-Blair, Inc., Series 913.
 2. Materials:
 - a. Flange and Flanged Body: Ductile iron or low carbon steel having a minimum yield strength of 30,000 psi.
 - b. Follower Ring: Low carbon steel having a minimum yield strength of 30,000 pounds per square inch.
 - c. Bolts and Hex Nuts:
 - 1) Aboveground: High-strength, low-alloy steel in accordance with AWWA C111.
 - 2) Buried and Underwater: Type 316 stainless steel bolts in accordance with ASTM F 593.
 3. Flange Design: Class D steel ring flange in accordance with AWWA C207 compatible with ANSI Class 125 and 150 bolt circles.
 4. Coating and Lining: Manufacturer's standard fusion bonded epoxy, NSF 61 certified.

- C. Flexible Couplings:
1. Manufacturers: One of the following or equal:
 - a. Dresser, Inc., Style 38.
 - b. Smith-Blair, Inc., Series 411.
 - c. Romac Industries, Inc., Style 511 or Style 400.
 2. Materials:
 - a. Center Sleeve and Follower Flanges: Ductile iron or low carbon steel having a minimum yield strength of 30,000 pounds per square inch.
 - b. Bolts and Hex Nuts:
 - 1) Aboveground: High strength, low alloy steel in accordance with AWWA C111.
 - 2) Buried and Underwater: Type 316 stainless steel bolts in accordance with ASTM F 593.
 3. Coating and Lining: Manufacturer's standard fusion bonded epoxy, NSF 61 certified.
 4. Center Sleeve Dimensions: Provide center sleeves with lengths in accordance with following table:

Nominal Pipe Diameter	Sleeve Length
2-1/2 inch and smaller	Manufacturer's standard
3 inch through 6 inch	7 inch
8 inch through 14 inch	7 inch
Greater than 14 inches	10 inch

- D. Restrained Flange Coupling Adapters:
1. Manufacturers: One of the following or equal:
 - a. Romac Industries, Inc., Style RFCA.
 2. Materials:
 - a. Flange and Flanged Body: Ductile iron in accordance with ASTM A 536.

- b. Follower Ring: Lug type restraint system.
 - 1) Follower Ring: Ductile iron in accordance with ASTM A 536.
 - 2) Restraining Lugs: Ductile iron in accordance with ASTM A 536.
 - a) Designed to contact the pipe and apply forces evenly.
 - 3) Restraining Bolts: Ductile iron in accordance with ASTM A 536. Bolt heads shall be designed to twist off when proper torque is applied.
- c. Bolts and Hex Nuts:
 - 1) Aboveground: High-strength, low-alloy steel as specified in AWWA C111.
 - 2) Buried and Underwater: Type 316 stainless steel bolts in accordance with ASTM F 593.
- 3. Flange Design: Class D steel ring flange in accordance with AWWA C207 compatible with ANSI Class 125 and 150 bolt circles.
- 4. Coating and Lining: Manufacturer's standard fusion-bonded epoxy certified in accordance with NSF 61.

2.03 GASKETS FOR FLEXIBLE COUPLINGS AND FLANGED COUPLING ADAPTERS

- A. Provide gasket materials for process piping applications as follows:
 - 1. Low-Pressure and High-Pressure Air, Steam, Hot Water: EPDM.
 - 2. All Other Process Piping Applications: EPDM or Viton®.

2.04 EXTERIOR COATINGS FOR UNDERGROUND AND SUBMERGED APPLICATIONS

- A. Manufacturers: One of the following or equal:
 - 1. Tapecoat Company, Inc., T.C. Mastic.
 - 2. Kop-Coat Company, Inc., Bitumastic Number 50.
- B. Thickness: Minimum 0.040 inch.

PART 3 EXECUTION

3.01 INSTALLATION

- A. In underground and underwater installations, coat the exterior of coupling with a protective coating after installation.
- B. Joints and flexible connections shall be installed centered with no angular deflection unless otherwise indicated on the Drawings.
- C. Flexible Couplings and Flange Coupling Adapters: Install with gap between pipe ends in accordance with the following table unless a greater gap is indicated on the Drawings. Maximum gap tolerance shall be within 1/8 inch.
 - 1. Install flexible coupling with pipe gap located in middle of center sleeve.
 - 2. Install flanged coupling adapter with end of plain end pipe in middle of flanged coupling body.

Center Ring Length	Gap Dimension and Tolerance
4 inch through 6 inch	3/8 inch
7 inch	5/8 inch
10 inch and greater	7/8 inch

- D. Provide harnesses (tie-downs) for flexible couplings unless otherwise indicated on the Drawings with a written note.
 - 1. Design harnesses (tie-downs) for the test pressures as specified in the Piping Schedule in Section 15052.

END OF SECTION

SECTION 15251

DUCTILE IRON AWWA C151 PIPE

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes: Ductile iron pipe, joints, fittings, gaskets, and pipe linings and coatings.
- B. Related sections:
 - 1. The Contract Documents are complementary; what is called for by one is as binding as if called for by all.
 - 2. It is the CONTRACTOR's responsibility for scheduling and coordinating the Work of subcontractors, suppliers, and other individuals or entities performing or furnishing any of CONTRACTOR's Work.
 - 3. The following Sections are related to the Work described in this Section. This list of Related Sections is provided for convenience only and is not intended to excuse or otherwise diminish the duty of the CONTRACTOR to see that the completed Work complies accurately with the Contract Documents.
 - a. Section 02318 - Trenching.
 - b. Section 09960B - Coatings.
 - c. Section 15052 - Basic Piping Materials and Methods.
 - d. Section 15121 - Pipe Couplings.

1.02 REFERENCES

- A. American Society of Mechanical Engineers (ASME):
 - 1. B16.1 - Cast Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250.
- B. American Water Works Association (AWWA):
 - 1. C104 - Standard for Cement-Mortar Lining for Ductile-Iron Pipe and Fittings.
 - 2. C105 - Polyethylene Encasement for Ductile-Iron Pipe Systems.
 - 3. C110 - Standard for Ductile-Iron and Gray-Iron Fittings.
 - 4. C111 - Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
 - 5. C115 - Flanged Ductile-Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges.
 - 6. C150 - Standard for Thickness Design of Ductile-Iron Pipe.
 - 7. C151 - Standard for Ductile-Iron Pipe, Centrifugally Cast.
 - 8. C600 - Installation of Ductile-Iron Water Mains and Their Appurtenances.
 - 9. C606 - Standard for Grooved and Shouldered Joints.
- C. American Welding Society (AWS):
 - 1. D11.2 - Guide for Welding Iron Castings.
- D. ASTM International (ASTM):
 - 1. A 47 - Standard Specifications for Ferritic Malleable Iron Castings.

2. A 183 - Standard Specifications for Carbon Steel Track Bolts and Nuts.
 3. A 536 - Standard Specifications for Ductile Iron Castings.
 4. C 283 - Standard Test Methods for Resistance of Porcelain Enameled Utensils to Boiling Acid.
 5. D 792 - Standard Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement.
- E. Ductile Iron Pipe Research Association (DIPRA):
1. Thrust Restraint Design Manual.
- F. NACE International (NACE):
1. SP0188 - Discontinuity (Holiday) Testing of New Protective Coatings on Conductive Substrates.
- G. National Association of Pipe Fabricators, Inc. (NAPF):
1. 500-03 - Surface Preparation Standard for Ductile Iron Pipe and Fittings in Exposed Locations Receiving Special External Coatings and/or Special Internal Linings.
- H. Steel Structures Painting Council (SSPC):
1. PA-2 - Measurement of Dry Coating Thickness With magnetic Gages.

1.03 SYSTEM DESCRIPTION

- A. Thrust restraint system design:
1. Design restrained joint thrust restraint system.
 2. Determine the length of pipe that must be restrained on each side of the focus of a thrust load in accordance with the procedures and criteria established by the DIPRA Thrust Restraint Design Manual as specified in Piping Schedule in Section 15052 and the following additional criteria:
 - a. Design pressure: Test pressure.
 - b. Laying condition: Type 3 in accordance with AWWA C150.
 - c. Soil designation: Silt 1 as defined by DIPRA.
 - d. Unit friction resistance: Based upon polyethylene encasement of pipe.
 - e. Safety factor: 1.5 (for thrust restraint calculations only).

1.04 SUBMITTALS

- A. Product data: Photographs, drawings, and descriptions of fittings, gaskets, couplings, grooving of pipe and fittings, pipe linings, and coatings.
- B. Shop drawings:
1. Detailed layout drawings showing alignment of pipes, location of valves, fittings, and appurtenances, types of joints, connections to structures, and thrust restraint system layouts.
 2. Thrust restraint systems: Calculations and layout for restrained joint thrust restraint systems.
- C. Design calculations:
1. Calculations for thrust restraint system design.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Block piping and associated fittings for shipment to prevent damage to coatings and linings.
- B. Carefully handle piping and associated fittings during loading, unloading, and installation. Do not drop piping material from cars or trucks. Lower piping by mechanical means. Do not drop or pound pipe to fit grade.
- C. Protect gaskets and polyethylene encasement from long-term exposure to sunlight.
- D. Store piping, fittings, and other accessories such that they do not accumulate and hold rainwater, dirt, and debris.

PART 2 PRODUCTS

2.01 MANUFACTURED UNITS

- A. Ductile iron piping:
 - 1. Typical type: In accordance with AWWA C150 and AWWA C151. Pressure class or special thickness class as indicated in the Piping Schedule provided in Section 15052.
 - 2. Type with screw-on flanges: In accordance with AWWA C115 with minimum special thickness Class 53 wall thickness as required for screw-on flanges. Special thickness class as indicated in the Piping Schedule as specified in Section 15052.
 - 3. Type with grooved couplings: Special thickness class as indicated in the Piping Schedule as specified in Section 15052.
- B. Joints:
 - 1. Flanged joints:
 - a. Screw-on flanges: Comply with the diameter, thickness, drilling, and other characteristics in accordance with ASME B16.1. In addition, comply with the following requirements:
 - 1) Ductile iron.
 - 2) Long hub, threaded, and specially designed for ductile iron pipe.
 - 3) After attaching to pipe, machine flange face to make pipe end and flange even and perpendicular to the axis of the pipe.
 - b. Bolt holes on flanges: 2-holed and aligned at both ends of pipe.
 - c. Cap screw or stud bolt holes: Tapped.
 - d. Bolts and nuts: As specified in Section 15052
 - e. Gaskets: Standard EPDM unless specified otherwise in Section 15052.
 - 2. Grooved joints: In accordance with AWWA C606, as complemented and modified below, radius-cut type, with following components:
 - a. Couplings: Rigid type, cast from ductile iron in accordance with ASTM A 536, Grade 65-45-12, or malleable iron in accordance with ASTM A 47, Grade 32510.
 - b. Bolts and nuts: In accordance with ASTM A 183, Grade 2.
 - c. Gaskets: Capable of being applied on surface of piping with cavities to provide for an improved seal with the internal piping pressure. Material to be used for following services:
 - 1) For liquid service: EPDM or Viton®.

- 2) For air service: Fluoroelastomer.
 - 3) For hot water service: EPDM.
- d. Fittings: In accordance with AWWA C606, rigid radius-cut groove:
 - 1) Center-to-center dimensions: In accordance with AWWA C110.
 - 2) Wall thickness and other characteristics: In accordance with AWWA C606.
- e. Flanged unit connections: A long enough spool with one end flanged and the other end grooved to prevent interference with the operation of adjacent valves, pumps, or other items.
- 3. Mechanical joints: In accordance with AWWA C111.
- 4. Push-on rubber gasket joints: In accordance with AWWA C111.
- 5. Integrally restrained mechanical joints:
 - a. Application: Where designation Mech Rest. MJ is specified in the Piping Schedule provided in Section 15052 or is indicated on the Drawings, supply a restrained mechanical joint piping system, which includes restrained mechanical joints where necessary based upon thrust calculations. Standard mechanical joints as specified above can be used where thrust calculations demonstrate restraint is not required.
 - b. Design: Integral retainer weldment type or lugged type joint with Type 304 stainless steel rods and nuts. Restrained mechanical joints of the configuration which utilizes a gripping or friction force for restraint will not be acceptable.
 - c. Manufacturers: Where restrained mechanical joints are required, use one of the following or equal:
 - 1) American Cast Iron Pipe Company, MJ Coupled Joint.
 - 2) Pacific States Cast Iron Pipe Company, Lock Mechanical Joint.
- 6. Restrained mechanical joints: As specified in Section 15121
- 7. Integrally restrained push-on joints:
 - a. Application: Where designation restrained push-on [is specified in the Piping Schedule provided in Section 15052 or as indicated on the Drawings, supply a restrained push-on joint piping system, which includes restrained push-on joints where necessary based upon thrust calculations. Standard push-on rubber gasket joints as specified above can be used where thrust calculations demonstrate restraint is not required.
 - b. Design:
 - 1) Restrained push-on joints of the configuration which utilizes a gripping or friction force for restraint will not be acceptable.
 - 2) Suitable for the following working pressures:
 - a) For 4 through 24-inch pipe: 350 pounds per square inch gauge.
 - c. Manufacturers: One of the following or equal:
 - 1) United States Pipe and Foundry Company, TR Flex.
 - 2) Pacific States Cast Iron Pipe Company, Thrust Lock.
 - 3) American Cast Iron Pipe Company, Flex Ring or Lok-Ring.
 - d. Limit buried joints to half the manufacturer's published allowable angular joint deflection for purposes of pipeline alignment and elimination of fittings.

C. Fittings:

- 1. Ductile iron in accordance with AWWA C110.
- 2. Joint type: Same as that of the associated piping as specified in Section 15052.
- 3. Plain end-to-flanged joint connectors using setscrews are not acceptable.

- D. Pipe linings and coatings:
 - 1. Cement-mortar lining:
 - a. In accordance with AWWA C104, apply cement-mortar on clean bare metal surfaces. Extend to faces of flanges, ends of spigots, and shoulders of hubs.
 - b. Minimum lining thickness: Standard in accordance with AWWA C104.
 - c. Type of cement: Type II.
 - 2. Asphaltic seal coat:
 - a. Apply to outside surface of pipes that will not receive another coating. Apply in accordance with AWWA C151.

2.02 POLYETHYLENE ENCASEMENT

- A. 2 layers of linear low-density polyethylene (LLDPE) film, minimum thickness of 8 mils in accordance with AWWA C105, or
- B. Single layer of high-density, cross-laminated polyethylene (HDCLPE) film, minimum thickness of 4 mils in accordance with AWWA C105.

PART 3 EXECUTION

3.01 INSTALLATION

- A. General:
 - 1. Install ductile iron piping in accordance with AWWA C600, modified as specified in Section 15052.
 - 2. For underground piping, the trenching, backfill, and compaction: As specified in Section 02318.
- B. Polyethylene encasement:
 - 1. Wrap all buried ductile iron pipe and fittings in 2 layers of loose polyethylene wrap in accordance with AWWA C105.
 - 2. Polyethylene encasement shall be continuous and terminated neatly at connections to below grade equipment or structures.
 - 3. At wall penetrations, extend encasement to the wall and neatly terminate.
 - 4. At slab penetrations, extend encasement to 2 inches below the top of slab and neatly terminate.
 - 5. When rising vertically in unimproved areas, extend encasement 6 inches above existing grade and neatly terminate.
 - 6. Repair tears and make joints with 2 layers of plastic tape.
 - 7. All work shall be inspected prior to backfilling of pipe and associated items.
- C. Joints:
 - 1. Install types of joints as specified in the piping schedule provided in Section 15052.
 - 2. Mechanical joints are not acceptable in above ground applications.
 - 3. Field closure for restrained push-on pipe:
 - a. Locate field closures in areas where thrust calculations demonstrate restraint is not required.
 - 4. Grooved joints:
 - a. Install piping with grooved joints where specified in the piping schedule as specified in Section 15052 or indicated on the Drawings.

- b. Assemble grooved joints in accordance with manufacturer's published instructions.
 - c. Support grooved-end pipe in accordance with manufacturer's published instructions. Install at least 1 support between consecutive couplings.
- D. Tapping ductile iron pipe:
 - 1. Direct tapping of ductile iron pipe may be performed but is limited to the following conditions:
 - a. Two layers of 3-mil thread sealant are required to minimize the torque required to effect a watertight connection.

3.02 FIELD QUALITY CONTROL

- A. Testing ductile iron piping:
 - 1. Test as specified in Section 15052.
 - 2. Do not test sections longer than _____ feet in total pipe length.
- B. Repair damaged cement mortar lining to match quality, thickness, and bonding of original lining in accordance with AWWA C104. When lining cannot be repaired or repairs are defective, replace defective piping with undamaged piping.

END OF SECTION

SECTION 15265

PLASTIC PIPING AND TUBING

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes: Plastic pipe, tubing, and fittings.
- B. Related sections:
 - 1. The Contract Documents are complementary; what is called for by one is as binding as if called for by all.
 - 2. It is the CONTRACTOR's responsibility for scheduling and coordinating the Work of subcontractors, suppliers, and other individuals or entities performing or furnishing any of CONTRACTOR's Work.
 - 3. The following Sections are related to the Work described in this Section. This list of Related Sections is provided for convenience only and is not intended to excuse or otherwise diminish the duty of the CONTRACTOR to see that the completed Work complies accurately with the Contract Documents.
 - a. Section 15052 - Basic Piping Materials and Methods.
 - b. Section 15251 - Ductile Iron Piping.
 - c. Section 15956 - Piping Systems Testing.

1.02 REFERENCES

- A. American Society of Mechanical Engineers (ASME):
 - 1. B16.12 - Cast Iron Threaded Drainage Fittings.
- B. ASTM International (ASTM):
 - 1. D 1784 - Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds.
 - 2. D 1785 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80 and 120.
 - 3. D 1869 - Standard Specification for Rubber Rings for Asbestos-Cement Pipe.
 - 4. D 2412 - Standard Test Method for Determination of External Loading Characteristics of Plastic Pipe by Parallel-Plate Loading.
 - 5. D 2466 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.
 - 6. D 2467 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.
 - 7. D 2513 - Standard Specification for Thermoplastic Gas Pressure Pipe, Tubing and Fittings.
 - 8. D 2564 - Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems.
 - 9. D 2665 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings.
 - 10. D 2855 - Standard Practice for Making Solvent-Cemented Joints with Poly (Vinyl Chloride)(PVC) Pipe and Fittings.

11. D 3034 - Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
 12. F 438 - Standard Specification for Socket-Type Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 40.
 13. F 439 - Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80.
 14. F 441 - Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe, Schedules 40 and 80.
 15. F 477 - Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
 16. F 493 - Standard Specification for Solvent Cements for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe and Fittings.
 17. F 645 - Standard Guide for Selection, Design and Installation of Thermoplastic Water-Pressure Piping Systems.
- C. American Water Works Association (AWWA):
1. C900 - Standard for Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 Inches to 12 Inches (100 mm Through 300 mm), for Water Transmission Distribution.
 2. C905 - Standard for Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 14 Inches through 48 Inches, for Water Transmission and Distribution.
- D. NSF International (NSF).

1.03 ABBREVIATIONS

- A. CPVC: Chlorinated polyvinyl chloride.
- B. DR: Dimension ratio.
- C. ID: Inside diameter of piping or tubing.
- D. NPS: Nominal pipe size followed by the size designation.
- E. NS: Nominal SIZE of piping or tubing.
- F. PVC: Polyvinyl chloride.
- G. SDR: Standard dimension ratio; the outside diameter divided by the pipe wall thickness.

1.04 SUBMITTALS

- A. Product data: Describe materials, pipe, fittings, gaskets, and solvent cement.
- B. Manufacturer's Published Installation Instructions.
- C. Certificates:
1. Submit manufacturer's certificate attesting that plastic pipe, tubing, and fitting types meet specified requirements:
 - a. PVC gravity sewer piping: In accordance with ASTM D 3034 or ASTM F 679, as applicable.

2. Manufacturer's certification of date of manufacture of plastic pipe and tubing for each lot delivered.
3. Copies of solvent cement manufacturer's report and certification in accordance with ASTM D 2564 for PVC piping, and ASTM F 493 for CPVC piping.
4. Certificates required by AWWA C900 and C905.

1.05 QUALITY ASSURANCE

- A. Fusion machine technician qualifications: 1-year experience in the installation of similar PE piping systems from the same manufacturer.
- B. Plastic pipe in potable water applications: Provide pipe and tubing bearing NSF seal.
- C. Mark plastic pipe with nominal size, type, class, schedule, or pressure rating, manufacturer and all markings required in accordance with ASTM and AWWA standards.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Protect piping materials from sunlight, scoring, and distortion.
- B. Do not allow surface temperatures on pipe and fittings to exceed 120 degrees F.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Extruding and molding material: Virgin material containing no scrap, regrind, or rework material except where permitted in the referenced standards.
- B. Fittings: Same material as the pipe and of equal or greater pressure rating, except that fittings used in drain, waste, and vent piping systems need not be pressure rated.
- C. Unions 2-1/2 inches and smaller: Socket end screwed unions. Make unions 3 inches and larger of socket flanges with 1/8-inch full-face soft EPDM or Viton[®] gasket.

2.02 PVC PIPING, SCHEDULE TYPE

- A. Materials:
 1. PVC Pipe: Designation PVC 1120 in accordance with ASTM D 1785 and appendices:
 - a. Pipe and fittings: Extruded from Type I, Grade 1, Class 12454-B material in accordance with ASTM D 1784.
 - b. PVC Pipe: Schedule 80 unless otherwise indicated on the Drawings.
 2. Fittings:
 - a. Supplied by pipe manufacturer.
 - b. Pressure fittings: In accordance with ASTM D 2466 or ASTM D 2467.
 - c. DWV fittings: In accordance with ASTM D 2665.

3. Solvent cement: In accordance with ASTM D 2564:
 - a. Chemical service: For CPVC or PVC pipe in chemical service, provide the following primer and cement, or equal:
 - 1) Primer: IPS Corp Type P70.
 - 2) Cement: IPS Corp Type 724 cement or another cement certified by the manufacturer for chemical service.

2.03 PVC PIPING, CLASS TYPE

- A. Fittings: Ductile iron with transition gasket sized to accommodate the outside pipe diameter.
- B. PVC pipe, Class Type: In accordance with AWWA C900 or AWWA C905, DR not more than 18 for C900 and 21 for C905. See Pipe Schedule.
 1. Fittings: Cast or ductile iron fittings as specified in Section 15251, sized for the dimensions of the pipe being used.
 2. Joint design: Push-on or mechanical joint type as identified in Piping Schedule.
 3. Gaskets: EPDM or Viton® in accordance with ASTM D 1869 or ASTM F 477.
 4. Color: Purple per California-Nevada Section of AWWA and per California Department of Public Health requirements.

2.04 JOINT RESTRAINT

- A. Provide restrained joints at non-flanged fittings and along the pipe where indicated on the Drawings.
- B. Manufacturer: EBAA Iron Megalug or equal.
- C. Design:
 1. Restraining Devices: Multiple gripping wedges and follower gland.
 2. Meeting applicable provisions of AWWA C153, C110, and C111.
 3. Wedges: Spread load on pipe wall as approved by ENGINEER.
 4. Design for full-rated pressure of pipe and a Safety Factor of 2.
 5. Conform to ASTM F 1674.
- D. Material:
 1. Gland, Wedges, and Wedge Actuating Components: ASTM A 536 ductile iron, grade 65-45-12.
 2. Hardware and Tie Rods: Type 316 stainless steel.
 3. Elastomeric Components in Contact with Product: EPDM.
 4. Coatings: Fusion-bonded epoxy per Section 15110, Megabond, or equal.
- E. Types Based EBAA Iron, As Applicable:
 1. At Mechanical Joint Fittings: Series 2000.
 2. At Joints in Straight Pipe: Series 2800.
 3. At PVC Pipe Bells: Series 2500.

2.05 CPVC PIPING

A. Materials:

1. CPVC pipe: Schedule 80, in accordance with ASTM F 441 and Appendix, CPVC 4120:
 - a. Pipe: Extruded from Type IV, Grade 1, Class 23447 material in accordance with ASTM D 1784.
 - b. Manufacturers: One of the following or equal:
 - 1) Charlotte Pipe and Foundry Company.
 - 2) Eslon Thermoplastics, Inc.
 - 3) Harvel Plastics, Inc.
2. Fittings: In accordance with ASTM F 438 or ASTM F 439 for pressure fittings, as appropriate to the service and pressure requirement:
 - a. Fittings: Supplied by the pipe manufacturer.
 - b. Manufacturers: One of the following or equal:
 - 1) Colonial Engineering.
 - 2) Eslon Thermoplastics, Inc.
 - 3) Chemtrol.
 - 4) Spears Manufacturing Company; or equal.
3. Solvent cement: In accordance with ASTM F 493:
 - a. For CPVC pipe in chemical service, utilize IPS Corp Type 724 cement or another cement certified by the manufacturer for high strength hypochlorite service.

2.06 SOURCE QUALITY CONTROL

A. PVC piping, Schedule Type:

1. Mark pipe and fittings in accordance with ASTM D 1785.

B. PVC piping, Class Type:

1. Test pipe to withstand, without failure, 600 pounds per square inch gauge, hydrostatic pressure for a minimum of 5 seconds.
2. Test integral bell with the pipe.

C. PVC gravity sewer piping:

1. Mark pipe and fittings in accordance with ASTM D 3034. Also mark the production control code on pipe and fittings.

D. CPVC piping:

1. Mark pipe and fittings in accordance with ASTM F 441.

PART 3 EXECUTION

3.01 INSTALLATION

A. General:

1. Where not otherwise specified, install piping in accordance with ASTM F 645, or manufacturer's published instructions for installation of piping, as applicable to the particular type of piping.
2. Provide molded transition fittings for transitions from plastic to metal or IPS pipe. Do not thread plastic pipe.

3. Locate unions where indicated on the Drawings, and elsewhere where required for adequate access and assembly of the piping system.
 4. Provide serrated nipples for transition from plastic pipe to rubber hose.
- B. Installation of PVC piping, Schedule Type:
1. Solvent weld joints in accordance with ASTM D 2855:
 - a. For PVC pipe in chemical service use IPS Corp. Type 724 cement in accordance with manufacturer's instructions.
 2. Install piping in accordance with manufacturer's published instructions.
- C. Installation of PVC piping, Class Type:
1. Install piping in accordance with the Appendix of AWWA C900 complemented with manufacturer's published instructions.
- D. Installation of CPVC piping:
1. Clean dirt and moisture from pipe and fittings.
 2. Bevel pipe ends in accordance with manufacturer's instructions with chamfering tool or file. Remove burrs.
 3. Use solvent cement and primer formulated for CPVC:
 - a. For CPVC pipe in chemical service use IPS Corp. Type 724 cement in accordance with manufacturer's instructions.
 4. Use primer on pressure and non-pressure joints.
 5. Do not solvent weld joints when ambient temperatures are below 40 degrees F or above 90 degrees F unless solvent cements specially formulated for these conditions are utilized.

3.02 FIELD QUALITY CONTROL

- A. Leakage test for PVC piping, Class Type:
1. Polyvinyl chloride (PVC) piping, Class Type: Subject to visible leaks test and to pressure test with maximum leakage allowance, as specified in Section 15956.
 2. Pressure test with maximum leakage allowance: Perform test after backfilling:
 - a. Pressure: 150 pounds per square inch, gauge.
 - b. Maximum leakage allowance as follows, wherein the value for leakage in C900 PVC pipe is in gallons per 100 joints per hour:

NPS, Inches	1-1/2	2	2-1/2	3	4	6	8	10	12
Leakage	0.41	0.52	0.63	0.76	0.98	1.45	1.88	2.35	2.80

END OF SECTION

SECTION 15267

HIGH-DENSITY POLYETHYLENE PIPE AND FITTINGS

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes: High-Density Polyethylene (HDPE) Pipe, and fittings.
- B. Related sections:
 - 1. The Contract Documents are complementary; what is called for by one is as binding as if called for by all.
 - 2. It is the CONTRACTOR's responsibility for scheduling and coordinating the Work of subcontractors, suppliers, and other individuals or entities performing or furnishing any of CONTRACTOR's Work.
 - 3. The following Sections are related to the Work described in this Section. This list of Related Sections is provided for convenience only and is not intended to excuse or otherwise diminish the duty of the CONTRACTOR to see that the completed Work complies accurately with the Contract Documents.
 - a. Section 15052 - Basic Piping Materials and Methods.

1.02 REFERENCES

- A. American Water Works Association (AWWA):
 - 1. C906- Standard for Polyethylene (PE) Pressure Pipe And Fittings, 4 In. (100 mm) Through 63 In. (1,575 mm), for Water Distribution and Transmission.
- B. ASTM International (ASTM):
 - 1. D 1238 - Standard Test Method for Melt Flow Rates of Thermoplastics by Extrusion Plastometer.
 - 2. D 1248 - Standard Specification for Polyethylene Plastics Molding and Extrusion Materials.
 - 3. D 1505 - Standard Test Method for Density of Plastics by the Density-Gradient Technique.
 - 4. D 1599 - Standard Test Method for Resistance to Short-Time Hydraulic Pressure of Plastic Pipe, Tubing, and Fittings.
 - 5. D 1603 - Standard Test Method for Carbon Black Content in Olefin Plastics.
 - 6. D 2122 - Standard Test Method for Determining Dimensions of Thermoplastic Pipe and Fittings.
 - 7. D 2290 - Standard Test Method for Apparent Hoop Tensile Strength of Plastic or Reinforced Plastic Pipe by Split Disk Method.
 - 8. D 3261 - Standard Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing.
 - 9. D 3350 - Standard Specification for Polyethylene Plastic Pipe and Fittings Material.

10. F 645 - Standard Guide for Selection, Design, and Installation of Thermoplastic Water-Pressure Piping Systems.
 11. F 714 - Standard Specification for Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter.
- C. Plastic Pipe Institute (PPI):
1. PE 3408/PE 3608.

1.03 ABBREVIATIONS

- A. HDPE: High-density polyethylene.
- B. ID: Inside diameter of piping or tubing.
- C. OD: Outside diameter.
- D. SDR: Standard dimension ratio.

1.04 SUBMITTALS

- A. Product data: Describe materials and installation equipment including fusion machine. Include optimum range of fusion conditions such as fusion temperature, interface pressure, and cooling time.
- B. Manufacturer's Published Installation Instructions.
- C. Certificates:
 1. Submit manufacturer's certificate attesting that HDPE pipe and fitting types meet specified requirements.
 2. Manufacturer's certification of date of manufacture of HDPE pipe and fittings for each lot delivered.
- D. Qualifications of installation crew for HDPE pipe including qualifications of the fusion machine technician. Furnish proof of training in the use of fusion equipment.

1.05 QUALITY ASSURANCE

- A. Fusion machine technician qualifications: 3 years experience in the installation of similar PE piping systems from the same manufacturer.
- B. Markings on the pipe shall be in accordance with AWWA C906.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Protect piping materials from sunlight, scoring, and distortion.
- B. Do not allow surface temperatures on pipe and fittings to exceed 120 degrees Fahrenheit.
- C. Store and handle PE pipe and fittings as recommended by manufacturer in published instructions.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Extruding and molding material: Virgin material containing no scrap, regrind, or rework material except where permitted in the referenced standards.
- B. Fittings: Same material as the pipe and of equal or greater pressure rating.

2.02 HDPE PIPING

- A. General:
 - 1. Pipe and fittings: HDPE.
 - 2. Dimensions of pipe and fittings: Based on controlled outside diameter in accordance with ASTM F 714:
 - a. SDR: As given in Piping Schedule, Section 15052; or, if not given, minimum SDR = 9.
 - b. Pipe Diameter: IPS dimensions as specified in Section 15052 Pipe Schedule and as indicated on the Drawings.
- B. Materials:
 - 1. Manufacturers: One of the following or equal:
 - a. Performance Pipe.
 - b. Isco Industries.
 - c. Pipe, fittings, and adapters: Furnished by the same manufacturer, or compatible with components in the same system and with components of other systems to which connected.
 - 2. Polyethylene: In accordance with ASTM D 1248, Type III, Class C, Category 5, Grade P34; listed by the PPI under the designation PE 3408/PE 3608; and have a minimum cell classification, in accordance with ASTM D 3350, of 345464C:
 - a. Pipe and fittings: Manufactured from material with the same cell classification.
 - b. Manufacturer shall certify that pipe and fittings meet the above classifications.
 - 3. Polyethylene fittings and custom fabrications:
 - a. Molded or fabricated.
 - b. Butt fusion outlets shall be made to the same outside diameter, wall thickness, and tolerances as the mating pipe.
 - c. All fittings and custom fabrications shall be fully rated for the same internal pressure as the mating pipe.
 - d. Pressure de-rated fabricated fittings are prohibited.
 - 4. Molded fittings:
 - a. Manufactured in accordance with ASTM D 3261, Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing, and shall be so marked.
 - b. Each production lot of molded fittings shall be subjected to the tests required under ASTM D 3261.
 - 5. X-ray inspection: The manufacturer shall submit samples from each molded fittings production lot to x-ray inspection for voids, and shall certify that voids were not found.

6. Fabricated fittings:
 - a. Made by heat fusion joining specially machined shapes cut from pipe, polyethylene sheet stock, or molded fittings.
 - b. Rated for internal pressure service at least equal to the full service pressure rating of the mating pipe.
7. Polyethylene flange adapters:
 - a. Flange adapters shall be made with sufficient through-bore length to be clamped in a butt fusion joining machine without the use of a stub-end holder.
 - b. The sealing surface of the flange adapter shall be machined with a series of small v-shaped grooves to provide gasketless sealing, or to restrain the gasket against blowout.
8. Back-up rings and flange bolts:
 - a. Flange adapters shall be fitted with Type 304 or 316 stainless steel back-up rings pressure rated equal to or greater than the mating pipe.
 - b. The back-up ring bore shall be chamfered or radiused to provide clearance to the flange adapter radius.
 - c. Flange bolts and nuts shall be the same material as backing flange and as specified in Section 15052.

2.03 SOURCE QUALITY CONTROL

- A. HDPE piping:
 1. Manufacturer's quality control: The pipe and fitting manufacturer shall have an established quality control program responsible for inspecting incoming and outgoing materials.
 2. Incoming polyethylene materials:
 - a. Inspected for density, melt flow rate, and contamination.
 - b. The cell classification properties of the material shall be certified by the supplier, and verified by manufacturer's quality control.
 - c. Approved by quality control before processing into finished goods.
 3. Outgoing materials shall be checked for:
 - a. Outside diameter, wall thickness, and eccentricity in accordance with ASTM D 2122 at a frequency of at least once per hour.
 - b. Out of roundness at a frequency of at least once per hour.
 - c. Straightness, inside and outside surface finish, markings and end cuts shall be visually inspected in accordance with ASTM F 714 on every length of pipe:
 - 1) Quality control shall verify production checks and test for:
 - a) Density in accordance with ASTM D 1505 at a frequency of at least once per extrusion lot.
 - b) Melt Index in accordance with ASTM D 1238 at a frequency of at least once per extrusion lot.
 - c) Carbon content in accordance with ASTM D 1603 at a frequency of at least once per day in accordance with extrusion line.
 - d) Quick burst pressure in accordance with ASTM D 1599 at a frequency of at least once per day per line.
 - e) Ring Tensile Strength in accordance with ASTM D 2290 at a frequency of at least once per day per line.
 - d. X-ray inspection shall be used to inspect molded fittings for voids, and knit line strength shall be tested. All fabricated fittings shall be inspected for joint quality and alignment.

4. Permanent records: The manufacturer shall maintain permanent QC and QA records.
5. Compliance tests:
 - a. Manufacturer's inspection and testing of the materials.
 - 1) In case of conflict with manufacturer's certifications, the CONTRACTOR, CM, ENGINEER, or OWNER may request retesting by the manufacturer or have retests performed by an outside testing service.
 - 2) All retesting shall be at the requestor's expense, and shall be performed in accordance with this Section.

PART 3 EXECUTION

3.01 INSTALLATION

- A. General:
 1. Where not otherwise specified, install piping in accordance with ASTM F 645, or manufacturer's published instructions for installation of piping, as applicable to the particular type of piping.
 2. Provide molded transition fittings for transitions from HDPE to metal or IPS pipe. Do not thread or solvent weld HDPE pipe.
- B. Installation of HDPE piping:
 1. Joining:
 - a. Heat fusion joining:
 - 1) Joints between plain end pipes and fittings shall be made by butt fusion, and joints between the main and saddle branch fittings shall be made utilizing saddle fusion employing only procedures that are recommended by the pipe and fitting manufacturer.
 - 2) The CONTRACTOR shall certify, in writing, that persons making heat fusion joints have received training in the manufacturer's recommended procedure and have had at least 3 years current experience in the heat fusion butt welding process.
 - 3) The CONTRACTOR shall maintain records of trained personnel, and shall certify that training was received not more than 12 months before commencing construction.
 - 4) External and internal beads shall not be removed.
 - b. Heat fusion training services: The manufacturer shall provide training in the manufacturer's recommended butt fusion and saddle fusion procedures to the CONTRACTOR's installation personnel, and to the inspector(s) representing the OWNER, prior to the start of construction.
 - c. Mechanical joining:
 - 1) Polyethylene pipe and fittings may be joined together or to other materials by means of flanged connections (flange adapters and back-up rings) or, where specifically indicated on the Drawings, flexible couplings designed for joining polyethylene pipe or for joining polyethylene pipe to another material.
 - 2) Flexible couplings shall be fully pressure rated and fully thrust restrained such that when installed in accordance with manufacturer's recommendations, a longitudinal load applied to the

mechanical coupling will cause the pipe to yield before the mechanical coupling disjoins.

2. Installation:
 - a. General:
 - 1) The Manufacturer shall package products for shipment in a manner suitable for safe transport by commercial carrier.
 - 2) When delivered, a receiving inspection shall be performed, and any shipping damage shall be reported to the manufacturer within 7 days.
 - 3) Damaged pipe shall be promptly removed from the job site.
 - 4) Installation shall be in accordance with manufacturer's recommendations, and this specification.
 - 5) Prior to making a terminal connection of each individual run of HDPE pipe, the temperature of the pipe should be allowed to approach the service temperature at which the pipe is intended to operate.
 - 6) All necessary precautions shall be taken to ensure a safe working environment in accordance with applicable codes and standards.
 - b. Large diameter fabricated fittings: Fabricated fittings shall be butt fused to the end of a pipe.
 - c. Mechanical joint and flange installation:
 - 1) Mechanical joints and flange connections shall be installed in accordance with the manufacturer's recommended procedure.
 - 2) Flange faces shall be centered and aligned to each other before assembling and tightening bolts.
 - 3) Every effort shall be made to ensure that the opposing faces of the flange assemblies mate up securely at a temperature approximately the same as the service temperature.
 - 4) In no case shall the flange bolts be used to draw the flanges into alignment.
 - 5) Bolt threads shall be lubricated, and flat washers shall be fitted under the flange nuts.
 - 6) Bolts shall be evenly tightened according to the tightening pattern and torque step recommendations of the manufacturer.
 - 7) At least 1 hour after initial assembly, flange connections shall be re-tightened following the tightening pattern and torque step recommendations of the manufacturer.
 - 8) The final tightening torque shall be 100 ft-lbs or less as recommended by the manufacturer.
 - d. Pipe handling:
 - 1) Lift, move, or lower pipe and fittings only with wide fabric choker slings.
 - 2) Wire rope or chain shall not be used.
 - 3) Slings shall be of sufficient capacity for the load, and shall be inspected before use.
 - 4) Worn or defective equipment shall not be used.
 - e. Excavation, backfill material and backfilling and compacting: Per Section 02318.

3.02 FIELD QUALITY CONTROL

- A. Testing:
 1. Butt fusion testing.

2. Every day butt fusions are to be made, the first fusion of the day shall be a trial fusion.
 - a. The trial fusion shall be allowed to cool completely.
3. Fusion test straps shall be cut out.
 - a. The test strap shall be 12 inches (minimum) or 30 times the wall thickness in length with the fusion in the center, and 1 inch (minimum) or 1.5 times the wall thickness in width.
 - b. Bend the test strap until the ends of the strap touch.
4. If the fusion fails at the joint, a new trial fusion shall be made, cooled completely and tested.
5. Butt fusion of pipe to be installed shall not commence until a trial fusion has passed the bent strap test.
6. Data logging:
 - a. A data logger shall be installed on the fusion heated joining machine. Data on each joint shall be recorded by the data logger. Data to be recorded shall be minimum temperature of joint fusion and interface pressure of the fused joint.
7. Ultra-sonic testing:
 - a. Joints smaller than 14 inches diameter shall be tested utilizing ultra-sonic testing.
 - b. Test results shall be transmitted to the CM representative daily.
 - c. At the conclusion of the project, all test data shall be summarized, with all back-up data attached, and submitted to the CM as part of the final project closeout package.
8. Pressure testing:
 - a. Test pressures indicated in Section 15052.
 - b. Temperature of test water shall be no more than 73 degrees F, due to sensitivity of pipe pressure rating to temperature.

END OF SECTION

SECTION 15956

PIPING SYSTEMS TESTING

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes: Test requirements for piping systems.
- B. Related sections:
 - 1. The Contract Documents are complementary; what is called for by one is as binding as if called for by all.
 - 2. It is the CONTRACTOR's responsibility for scheduling and coordinating the Work of subcontractors, suppliers, and other individuals or entities performing or furnishing any of CONTRACTOR's Work.
 - 3. The following Sections are related to the Work described in this Section. This list of Related Sections is provided for convenience only and is not intended to excuse or otherwise diminish the duty of the CONTRACTOR to see that the completed Work complies accurately with the Contract Documents.
 - a. Section 01330 - Submittal Procedures.
 - b. Section 01410 - Regulatory Requirements.
 - c. Section 01500 - Temporary Facilities and Controls.
 - d. Section 15052 - Basic Piping Materials and Methods.

1.02 REFERENCES

- A. National Fuel Gas Code (NFGC).
- B. American Society of Mechanical Engineers (ASME):
 - 1. B31.1 - Power Piping.
 - 2. B31.3 - Process Piping.
 - 3. B31.8 - Gas Transmission and Distribution Piping Systems.
- C. Underwriters Laboratories Inc. (UL).

1.03 TESTING REQUIREMENTS

- A. General requirements:
 - 1. Testing requirements are stipulated in Laws and Regulations; are included in the Piping Schedule in Section 15052; are specified in the specifications covering the various types of piping; and are specified in this Section.
 - 2. Requirements in Laws and Regulations supersede other requirements of Contract Documents, except where requirements of Contract Documents are more stringent, including higher test pressures, longer test times, and lower leakage allowances.

3. Test plumbing piping in accordance with Laws and Regulations, the plumbing code, as specified in Section 01410, and UL requirements.
4. When testing with water, the specified test pressure is considered to be the pressure at the lowest point of the piping section under test.
 - a. Lower test pressure as necessary (based on elevation) if testing is performed at higher point of the pipe section.
- B. Furnish necessary personnel, materials, and equipment, including bulkheads, restraints, anchors, temporary connections, pumps, water, pressure gauges, and other means and facilities required to perform tests.
- C. Pipes to be tested: Test only those portions of pipes that have been installed as part of this Contract. Test new pipe sections prior to making final connections to existing piping. Furnish and install test plugs, bulkheads, and restraints required to isolate new pipe sections. Do not use existing valves as test plug or bulkhead.
- D. Unsuccessful tests:
 1. Where tests are not successful, correct defects or remove defective piping and appurtenances and install piping and appurtenances that comply with the specified requirements.
 2. Repeat testing until tests are successful.
- E. Test completion: Drain and leave piping clean after successful testing.
- F. Test water disposal: Dispose of testing water in accordance with requirements of federal, state, county, and city regulations governing disposal of wastes in the location of the Project and disposal site.

1.04 SUBMITTALS

- A. Submit as specified in Section 01330.
- B. Schedule and notification of tests:
 1. Submit a list of scheduled piping tests by noon of the working day preceding the date of the scheduled tests.
 2. Notification of readiness to test: Immediately before testing, notify ENGINEER in writing of readiness, not just intention, to test piping.
 3. Have personnel, materials, and equipment specified in place before submitting notification of readiness.

1.05 SEQUENCE

- A. Clean piping before pressure or leak tests.
- B. Test gravity piping underground, including sanitary sewers, for visible leaks before backfilling and compacting.
- C. Underground pressure piping may be tested before or after backfilling when not indicated or specified otherwise.

- D. Backfill and compact trench, or provide blocking that prevents pipe movement before testing underground piping with a maximum leakage allowance.
- E. Test underground piping before encasing piping in concrete or covering piping with slab, structure, or permanent improvement.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

3.01 TESTING ALIGNMENT, GRADE, AND DEFLECTION

- A. Alignment and grade:
 - 1. Visually inspect the interior of gravity piping with artificial light, reflected light, or laser beam.
 - 2. Consider inspection complete when no broken or collapsed piping, no open or poorly made joints, no grade changes that affect the piping capacity, or no other defects are observed.
- B. Deflection test:
 - 1. Pull a mandrel through the clean piping section under test.
 - 2. Perform the test not sooner than 30 days after installation and not later than 60 days after installation.
 - 3. Use a 9-rod mandrel with a contact length of not less than the nominal diameter of the pipe within 3 percent plus or minus.
 - 4. Consider test complete when the mandrel can be pulled through the piping with reasonable effort by 1 person, without the aid of mechanical equipment.

3.02 TESTING HIGH-HEAD PRESSURE PIPING

- A. Test piping for which the specified test pressure in the Piping Schedule is 20 pounds per square inch gauge or greater, by the high head pressure test method, indicated "HH" in the Piping Schedule.
- B. General:
 - 1. Test connections, hydrants, valves, blowoffs, and closure pieces with the piping.
 - 2. Do not use installed valves for shutoff when the specified test pressure exceeds the valve's maximum allowable seat differential pressure. Provide blinds or other means to isolate test sections.
 - 3. Do not include valves, equipment, or piping specialties in test sections if test pressure exceeds the valve, equipment, or piping specialty safe test pressure allowed by the item's manufacturer.
 - 4. During the performance of the tests, test pressure shall not vary more than plus or minus 5 pounds per square inch gauge with respect to the specified test pressure.
 - 5. Select the limits of testing to sections of piping. Select sections that have the same piping material and test pressure.

6. When test results indicate failure of selected sections, limit tests to piping:
 - a. Between valves.
 - b. Between a valve and the end of the piping.
 - c. Less than 500 feet long.
 7. Test piping for minimum 2 hours for visible leaks test and minimum 2 hours for the pressure test with maximum leakage allowance.
- C. Testing procedures:
1. Fill piping section under test slowly with water while venting air:
 - a. Use potable water.
 - b. Do not fill pipe at a rate exceeding 750 gpm.
 - c. Verify that all air valves are properly functioning.
 2. Before pressurizing for the tests, retain water in piping under slight pressure for a water absorption period of minimum 24 hours.
 3. Raise pressure to the specified test pressure and inspect piping visually for leaks:
 - a. Consider visible leakage testing complete when no visible leaks are observed.
- D. Pressure test with maximum leakage allowance:
1. Leakage allowance is zero for piping systems using flanged, National Pipe Thread threaded and welded joints.
 2. Pressure test piping after completion of visible leaks test.
 3. For piping systems using joint designs other than flanged, threaded, or welded joints, accurately measure the makeup water necessary to maintain the pressure in the piping section under test during the pressure test period:
 - a. Consider the pressure test to be complete when makeup water added is less than the allowable leakage and no damage to piping and appurtenances has occurred.
 - b. Successful completion of the pressure test with maximum leakage allowance shall have been achieved when the observed leakage during the test period is equal or less than the allowable leakage and no damage to piping and appurtenances has occurred.
 - c. When leakage is allowed, calculate the allowable leakage by the following formula:

$$L = S \times D \times P^{1/2} \times 133,200^{-1}$$

wherein the terms shall mean:

L = Allowable leakage in gallons per hour.

S = Length of the test section in feet.

D = Nominal diameter of the piping in inches.

P = Average observed test pressure in pounds per square inches gauge, at the lowest point of the test section, corrected for elevation of the pressure gauge.

x = The multiplication symbol.

END OF SECTION

SECTION 17404

PRESSURE/VACUUM MEASUREMENT - GAUGES

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes requirements for:
 - 1. Pressure/Vacuum gauges.
- B. Related Sections:
 - 1. The Contract Documents are complementary; what is called for by one is as binding as if called for by all.
 - 2. It is the CONTRACTOR's responsibility for scheduling and coordinating the Work of subcontractors, suppliers, and other individuals or entities performing or furnishing any of CONTRACTOR's Work.
 - 3. The following Sections are related to the Work described in this Section. This list of Related Sections is provided for convenience only and is not intended to excuse or otherwise diminish the duty of the CONTRACTOR to see that the completed Work complies accurately with the Contract Documents.
 - a. Section 01330 - Submittal Procedures.
 - b. Section 17050 - Process Control and Instrumentation Systems General Requirements.
 - c. Section 17401 - Pressure/Vacuum Measurement - Diaphragm and Annular Seals.
 - d. Section 17402 - Pressure/Vacuum Measurement - Instrument Valves.
- C. Provide all instruments identified in the Contract Documents

1.02 SUBMITTALS

- A. Furnish submittals in accordance with Section 01330.
- B. Additional Requirements:
 - 1. Product Data:
 - a. Accessories such as diaphragm seals, valve manifold, snubbers, and pulsation dampeners.

1.03 QUALITY ASSURANCE

- A. Examine the complete set of Contract Documents and verify that the instruments are compatible with the installed conditions including:
 - 1. Process conditions: Fluids, pressures, temperatures, flows, materials, etc.
 - 2. Physical conditions:
 - a. Installation and mounting requirements.
 - b. Location within the process.
 - c. Accessories: Verify that all required accessories are provided and are compatible with the process conditions and physical installation.
- B. Notify the ENGINEER if any installation condition does not meet the instrument manufacturer's recommendations or specifications.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers: One of the following or equal:
 - 1. Ashcroft:
 - a. Maximum pressure less than 10 PSI: Model 1189.
 - b. Maximum pressure greater than or equal to 10 PSI: Model 1279.
 - 2. Wika.
 - 3. Ametek U.S. Gauge.

2.02 MANUFACTURED UNITS

- A. General:
 - 1. Pressure gauge assembly shall include pressure sensing element, gauge case, and dial mechanism.
- B. Performance requirements:
 - 1. Pressure Range:
 - a. 0 to 160 psig unless indicated otherwise on the Drawings.
 - 2. Accuracy:
 - a. ± 1.0 percent of full scale after friction errors are eliminated by tapping or vibration.
 - b. Maximum allowable friction inaccuracy: ± 1.0 percent of full scale.
 - 3. Element:
 - a. Where the maximum pressure is less than 10 PSI, provide socket and bellows; for all other pressure ranges, employ a Bourdon tube.
 - b. Socket tips for bellows and Bourdon tube:
 - 1) Materials: Type 316 Stainless Steel.
 - c. Overpressure: Minimum 130 percent of maximum range pressure without damage to gauge or sensing element.
 - d. Wetted Materials: 316 Stainless Steel.
 - e. Dial Gauge:
 - f. Dial Size: 4-1/2 inches.
 - g. Dial case material: Aluminum.
 - h. Provide safety gauge with rupture disk and blow out back.
 - i. Dial face: Gasketed Shatterproof Glass or Polycarbonate.
 - j. Provide Gauge locks where possible.
 - k. Connection and Mounting:
 - 1) Direct mounted and suitable for outdoor installation.
 - 2) 1/2 inch NPT.
 - 3) Connection Material: Stainless Steel.
 - l. Pointer: Externally adjustable.

2.03 ACCESSORIES

- A. Provide diaphragm seals on all gauges:
 - 1. Diaphragm seal and pressure gauge shall be assembled by Manufacturer and shipped as an assembly.
- B. Provide means for stainless steel gauge valves for isolation:
 - 1. Mount valve manifold integrally to the gauge.
 - 2. Valve manifold and pressure gauge shall be assembled by manufacturer and shipped as an assembly.

2.04 SOURCE QUALITY CONTROL

- A. Refer to Section 17050.
- B. Factory calibrate each pressure gauge at a facility that is traceable to the National Institute of Standards and Technology (NIST).
- C. Provide complete documentation covering the traceability of all calibration instruments.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Coordinate the installation with all trades to ensure that the mechanical system has all necessary appurtenances including weld-o-lets, valves, etc. for proper installation of instruments.

3.02 FIELD QUALITY CONTROL

- A. Provide manufacturer's services to perform start-up and calibration or verification.

3.03 ADJUSTING

- A. Verify factory calibration of all instruments in accordance with the manufacturer's instructions:
 - 1. Return factory calibrated devices to the factory if they do not meet the field verification requirements for calibration.

3.04 DEMONSTRATION AND TRAINING

- A. Demonstrate performance of all instruments to the CM before commissioning:
 - 1. Furnish 0.5 hours of OWNER training.

END OF SECTION

